

RAILROAD GAZETTE

QUARTO VOL. XXIV.—NO. 23.

A JOURNAL OF TRANSPORTATION ENGINEERING AND RAILROAD NEWS. THIRTY-SEVENTH YEAR.

NEW YORK: Published at
73 Broadway.

FRIDAY, JUNE 3, 1892.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS MAIL MATTER OF THE SECOND CLASS.

\$4.20 PER YEAR TO U. S. AND CANADA.
6.08 " " FOREIGN COUNTRIES.

Brown Brothers & Co.,

PHILA. NEW YORK. BOSTON.
ALEX. BROWN & SONS, BALTIMORE

CONNECTED BY PRIVATE WIRES.

Members N. Y., Phila. and Baltimore Stock Exch's.

We buy and sell all first-class Investment Securities for customers. We receive accounts of Banks, Bankers, Corporations, Firms, and individuals, on favorable terms, and make collection of drafts drawn abroad on all points in the United States and Canada, and of drafts drawn in the United States on foreign countries.

We also buy and sell Bills of Exchange on, and make cable transfers to all points. Also make collections and issue Commercial and Travelers' Credits available in all parts of the world.

Letters of Credit.

BROWN, SHIPLEY & CO., LONDON.

SEE ADVERTISEMENT, PAGE III.

BLOCK SIGNALS, INTERLOCKING

AND

RAILROAD SAFETY APPLIANCES.

THE

BETHLEHEM IRON COMPANY,

80 Broadway, New York.

STEEL RAILS.

F. G. CORHAM, Sales Agent.

PRINCIPAL OFFICE AND WORKS:

SOUTH BETHLEHEM, PA.

WILSON BROTHERS & CO.,

Civil Engineers and Architects,

DREXEL BUILDING, PHILADELPHIA, PA.

Surveys made for Railway Lines.

Plans and Specifications furnished for Buildings,

Bridges, Water Works, Sewerage Systems, Harbor

Improvements and all classes of Engineering and

Architectural Work.

Construction of Work Attended To.

Examinations made of Railway, Mining and Other

Properties

R. MUSHET'S

"SPECIAL" AND "TITANIC"

STEELS.

Sole Representatives in the United States.

B. M. JONES & CO.

Nos. 11 & 13 Oliver St., BOSTON.

No. 143 Liberty St., NEW YORK.

SIGNALING

Interlocking Switch and Signal Apparatus, Semaphore Block and Station Signals.

Frogs and Crossings, Switches and Switch Stands.

ALLTOWN ROLLING MILLS.

Switch and Signal Dept., FRED'K S. GUERBER, Mgr't.

Office and Works, ALLTOWN, PA.

JAMES IRVINE, President.

GEO. B. F. COOPER, Vice-President.

NEW YORK EQUIPMENT COMPANY

15 WALL STREET, NEW YORK.

LOCOMOTIVES, PASSENGER AND FREIGHT CARS, ETC.,

Of both Standard and Narrow Gauge, to Railroad Companies, Logging Railroads, Mining Companies, Contractors, etc.

WE HAVE READY FOR IMMEDIATE DELIVERY, IN PERFECT ORDER,

Six standard-gauge locomotives, and a large number of 20 and 25-ton coal and flat cars.

CHAS. R. JOHNSON, Pres. and Gen. Man.

HENRY JOHNSON, Mgr. of Works and Treas.

D. W. PHELAN, Secretary.

H. M. SPERRY, Gen. Agent.

THE JOHNSON RAILROAD SIGNAL CO.,

Designers and Manufacturers of

Railroad Signaling Appliances,

INTERLOCKING and BLOCK SIGNALS.

Plans and bids submitted for interlocking Grade Crossings, Junctions, Yards,

Terminals, Passing Stations, etc.

DISTANT SWITCH SIGNALS.

ELECTRIC REPEATERS.

TORPEDO ATTACHMENTS.

Works and Main Office, RAHWAY, N. J.

ALBERT LUCIUS,

CIVIL AND MECHANICAL ENGINEER,

71 Broadway, N. Y. All kinds of Engineering

Structures, Plans, Specifications, Estimates,

Superintendence, Bridge Inspection & Reports.

George P. Whittlesey, Railroad Inventions

a specialty. PATENTS.

Late Examiner U. S. Patent Off.

Atlantic Building. WASHINGTON, D. C., U. S. A.

THE UNION SWITCH & SIGNAL CO.

GEO. WESTINGHOUSE, Jr., President.
E. H. Goodman, Vice-Pres. and Gen. Man. Jas. Johnson, Sec'y and Treas.
J. G. Schreuder, Chief Engineer. Geo. H. Paine, Gen'l Agt.

General Office and Works: SWISSVALE, Allegheny county, Penna., U. S. A.

Designers and Manfrs. of Interlocking and Block Signal Appliances, Frogs,

Slips, Switches, Switch Stands, Etc. Sole manufacturers of the Westinghouse

Pat. Pneumatic Interlocking and Automatic Block Signals Systems; Electric

Automatic Track Circuit Block Signals; Electric Locking; Sykes System; Electric Crossing

Alarm Bells; Saxby & Farmer Improved Interlocking; Special Appliances for protection of

Draw Bridges, etc., etc. Plans and Estimates Furnished on Application

BOSTON OFFICE: NEW YORK OFFICE: CHICAGO OFFICE:

Hathaway Building. Times Building. Home Insurance Building.

THE ROBERT W. HUNT & CO.

BUREAU OF INSPECTION, TESTS AND CONSULTATION
Nos. 631 and 633 THE HOOKERY, CHICAGO, ILL.

BRANCH OFFICES:

HAMILTON BUILDING, PITTSBURGH, PA. NO. 80 BROADWAY, NEW YORK.

338 CHESTNUT STREET, PHILADELPHIA.

ROBERT W. HUNT, M. Am. Soc. C. E., M. Am. Inst. M. E., M. Am. Soc. M. E., Late Gen.

Supt. Troy Steel & Iron Co.

JOHN J. CONE, Engineer of Tests. G. W. G. FERRIS, C. E.

A. W. FIERO, Inspecting Engineer. JAMES C. HALLSTED, C. E.

Inspection of Rails, Fish Plates, Cars and other Railway Material. Chemical and Physical

Laboratories. Analyses of Ores, Irons, Steels and Oils. Consultation on Iron and Steel

Metallurgy and Construction. Northwestern Agents for Riehle Bros. Testing Machines.

REGINALD CANNING & CO.,

RAILWAY EQUIPMENT,

115 BROADWAY, NEW YORK.

We have in stock, and for sale for Cash or on Car Trust Plan, Locomotives, Passenger

Combination and Freight Cars of every description.

TEN OPEN EXCURSION CARS, Standard Gauge.—A SPECIAL BARGAIN.

ST. LOUIS.

BLACKMER & POST,

MANUFACTURERS OF

SUPERIOR VITRIFIED SALT-GLAZED

STANDARD SEWER PIPE

—AND—

Double Strength Culvert Pipe,

IN TWO AND ONE-HALF FOOT SECTIONS WITH IMPROVED SOCKETS

—FOR—

RAILROAD CULVERTS & WATER WORKS CONDUITS

WRITE FOR PAMPHLET, "SOMETHING ABOUT CULVERT PIPE."

BLACKMER & POST,

ST. LOUIS.

Branch Office: Germania Building, St. Paul, Minn.

INTERLOCKING

Switch and Signal Dept., FRED'K S. GUERBER, Mgr't.

Office and Works, ALLTOWN, PA.

JAMES IRVINE, President.

GEO. B. F. COOPER, Vice-President.

NEW YORK EQUIPMENT COMPANY

15 WALL STREET, NEW YORK.

LOCOMOTIVES, PASSENGER AND FREIGHT CARS, ETC.,

Of both Standard and Narrow Gauge, to Railroad Companies, Logging Railroads, Mining Companies, Contractors, etc.

WE HAVE READY FOR IMMEDIATE DELIVERY, IN PERFECT ORDER,

Six standard-gauge locomotives, and a large number of 20 and 25-ton coal and flat cars.

CHAS. R. JOHNSON, Pres. and Gen. Man.

HENRY JOHNSON, Mgr. of Works and Treas.

D. W. PHELAN, Secretary.

H. M. SPERRY, Gen. Agent.

THE JOHNSON RAILROAD SIGNAL CO.,

Designers and Manufacturers of

Railroad Signaling Appliances,

INTERLOCKING and BLOCK SIGNALS.

Plans and bids submitted for interlocking Grade Crossings, Junctions, Yards,

Terminals, Passing Stations, etc.

DISTANT SWITCH SIGNALS.

ELECTRIC REPEATERS.

TORPEDO ATTACHMENTS.

Works and Main Office, RAHWAY, N. J.

ALBERT LUCIUS,

CIVIL AND MECHANICAL ENGINEER,

71 Broadway, N. Y. All kinds of Engineering

Structures, Plans, Specifications, Estimates,

Superintendence, Bridge Inspection & Reports.

George P. Whittlesey, Railroad Inventions

a specialty. PATENTS.

Late Examiner U. S. Patent Off.

Atlantic Building. WASHINGTON, D. C., U. S. A.

PENNSYLVANIA STEEL CO.

STEEL RAILS.

New York Office, 2 Wall Street.

STEPHEN W. BALDWIN, Agent.

CHAS. S. CLARK, 70 Kilby St., Boston, Mass.

G. D. PETERS & CO.,

Moorgate Works, Moorfields, London, Eng.,

MANUFACTURERS OF

RAILWAY SUPPLIES.

New inventions introduced and the sale and

manufacture of specialties undertaken.

OLIVER ADAMS

19 Liberty St., N. Y. P. O. Box 1304, NEW YORK.

CAR promptly negotiated for large TRUSTS

and small amounts.

GEO. A. EVANS,

18 WALL STREET, NEW YORK.

STEEL RAILS,

LOCOMOTIVES,

Passenger and Freight Cars.

Railway Fastenings, Frogs and

Switches.

ED. N. KIRK TALCOTT

Civil and Mechanical Engineer,

57 BROADWAY, NEW YORK.

Will advise MANUFACTURERS as to desir-

able locations for particular lines, and inspect

and procure plans for TOWNS WANTING

MANUFACTURES.

Bradford L. Gilbert

ARCHITECT,

TOWER BLDG., 50 Broadway, N. Y. City.

Specialty: Railroad Stations.

TURNBUCKLES

Cleveland City Forge & Iron Co.

CLEVELAND O.

New York Office, 136 Liberty St.

LOCOMOTIVE POP VALVES

THE ASHTON VALVES THE MOST EFFICIENT VALVES MADE.

THE ASHTON VALVE CO. 271 Franklin St., BOSTON

218 Lake St., CHICAGO

107 Liberty St., NEW YORK

CAB-BUILDERS DICTIONARY.

Price, \$2 a copy.

BOOKS

Molesworth's Pocket Book, \$2

Spon's Engineer's Tables, 40c

Catalogues free. E. & F. N. SPON

& CO., 12 Cortlandt St., N. Y.

PITTSBURGH TESTING LABORATORY.

HUNT & CLAPP, 116 Water St., Pittsburgh, Pa.

METALLURGICAL ENGINEERS AND CHEMISTS.

Specialties.—Inspection of rails and of material for bridges and other structures. Chem-

ical analyses and physical tests of all kinds. Agency for Tinius Olsen & Co.'s testing

machines and Thacher's Slide Rule. Slide rules kept constantly in stock. Price, \$30.00.

TRADE-MARKS, CAVEATS, COPYRIGHTS.

Send model or sketch for free advice as to

patentability. NEW BOOK, containing full

information to inventors, mailed to any ad-

dress FREE. Address

SAML. G. FITZGERALD, Atty.,

Equitable Bldg., WASHINGTON, D. C.

A. S. WHITON, No. 115 Broadway,

NEW YORK.

STEEL RAILS, Old Rails and Railway Supplies.

Contracts made for delivery in U. S., West Indies,

South America or F. O. B. English Ports.

WM. BARCLAY PARSONS,

M. Am. Soc. C. E.

CIVIL ENGINEER.

22 William Street, New York.

E. W. DEVOE & CO.'S COLORS AND VARNISHES ARE STANDARDS

NILES TOOL WORKS, HAMILTON, O., MACHINE TOOLS.

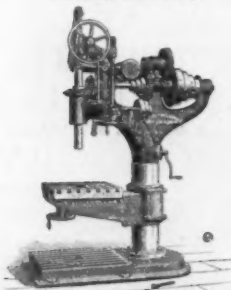
RAILROAD, CAR, LOCOMOTIVE AND MACHINE SHOPS FURNISHED WITH COMPLETE EQUIPMENT.

Driving-wheel Lathes,
Screw-cutting Engine Lathes,
Single and Double Axle Lathes,
Hydrostatic Wheel Presses,
Planers,
Special Switch and Frog Planers,
Shaping Machines,

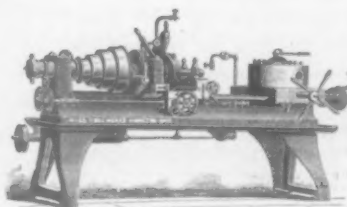
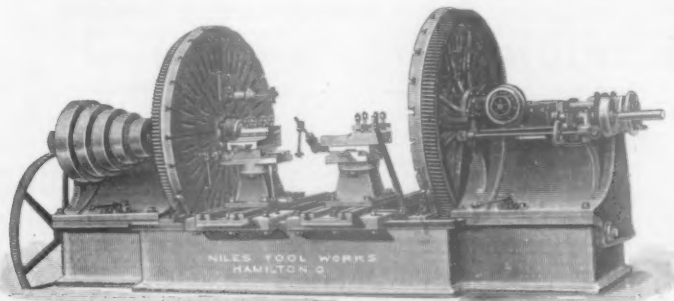
Boring and Turning Mills,
Horizontal Boring and Drilling Machines,
Vertical Drills,
Multiple Drills,
Arch-bar Drills,
Pulley Machines,
Car-wheel Lathes,

Heavy Forge Lathes,
Car-wheel Boring Machines,
Screw Machines,
Plate Planers,
Slotting Machines,
Cylinder Boring Machines

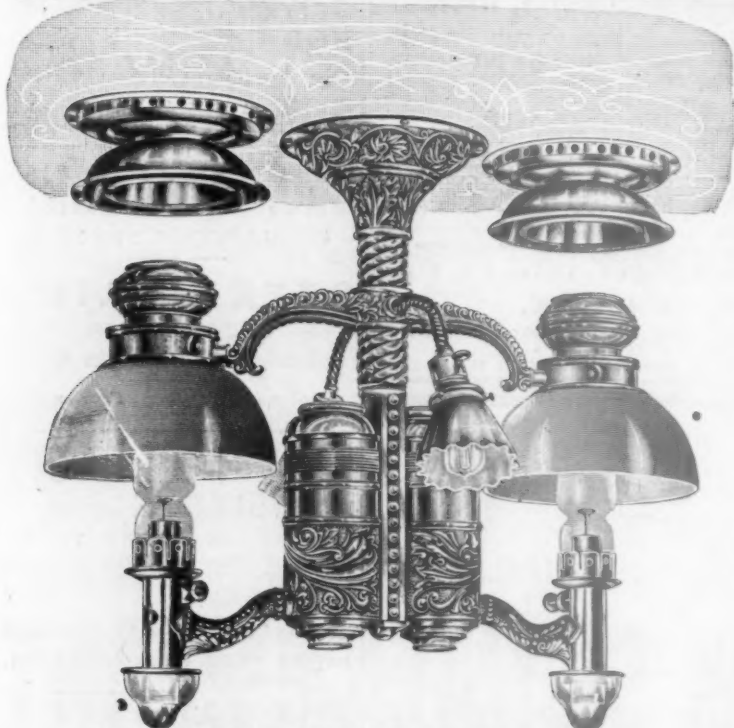
Universal Radial Drills,
Car-wheel Drills,
Rail Drills,
Power bending Rolls,
Plate-straightening Machines,
Etc., etc.



CHICAGO, Phenix Building.
PITTSBURGH, Lewis Block.



NEW YORK, 136 & 138 Liberty Street.



No. 121 "ACME" CHANDELIER, With Electric Fixtures.

THE ADAMS & WESTLAKE CO.,

MANUFACTURERS OF

Car Lamps, Lanterns, Headlights, Signals,
Switch and Train Tail Lights, etc.,

ALSO A COMPLETE LINE OF

Interior Car Trimmings,
Switch Locks,
Car Seats, etc., etc.

THE ADAMS & WESTLAKE CO.,
CHICAGO, ILL.

Marshall M. Kirkman's Books.

The following is a correct list of M. M. Kirkman's books now in print. Those not mentioned are either out of print or the editions have been burned.

"How to Collect Railway Revenue without Loss".....	\$2.50
"Treatise on the Method of Paying Large Bodies of Men".....	1.00
"The Track Accounts of Railroads: How They Should be Kept".....	1.00
"The Handling of Railway Supplies" and "Rules and Regulations Governing Requisitions".....	2.00
"Baggage, Parcel and Mail Traffic and Accounts".....	2.50
"Care of Cash by Agents and Conductors and Accounts Connected Therewith".....	2.00
"Handbook of Freight Traffic and Accounts".....	2.00
"Handbook of Passenger Traffic and Accounts".....	2.00

Mailed, Postage Prepaid, on Receipt of Price

THE RAILROAD GAZETTE, 73 Broadway, New York.

American Practice in Block Signaling.

With Descriptions and Drawings of the Different Systems in Use on Railroads in the United States.

This is a handsomely printed, elegantly bound volume, 7 3/4 in. x 9 in. It describes clearly the Simple Block System, Single Track Blocking Sykes' System, Automatic Clockwork Track Circuit Signals and the Electro-Pneumatic Track Circuit System. It contains elaborately illustrated descriptions of the systems in use on the Pennsylvania, Boston & Albany, Fitchburg and New York Central Roads, and correct engravings and descriptions of the Westinghouse Pneumatic, the Hall Automatic and Black's Automatic Systems; and also of the Illuminated Semaphore, Koyl's Parabolic Semaphore and the Stewart Hall Train Order Signal.

The book is designed to make the methods of block signaling clearly understood and to show the present development of the art on American railroads.

PRICE, \$2.00.

THE RAILROAD GAZETTE, 73 BROADWAY, NEW YORK.

Elements of Railroad Engineering.

By CHARLES FAIR.

A series of thirteen essays on "Surveys and Construction," "Drainage," "Real Estate and Records," "Telegraphs and Fences," "Main Line," "Trackmen and Sidings," "Stations," "Shops and Engine Houses," "Cars," "Locomotives," "Movement of Passengers," "Movement of Freight," "Management of Employees." This is probably the most interesting book on railroading ever published, and it is written by one of the most accomplished railroad officers now living. His long experience as Chief Engineer, General Superintendent and General Manager justifies him in speaking with authority, and all railroad men can read these essays with pleasure and profit. Price, \$1.00.

THE RAILROAD GAZETTE, 73 BROADWAY, N. Y.

NEW, REVISED, ENLARGED EDITION

—OF—

THE TRAIN WIRE,

A Discussion of the Science of Train Dispatching, by Mr.
J. A. Anderson, of the Pennsylvania Railroad, with
an Introduction by Mr. B. B. Adams, Jr.,
of the Railroad Gazette.

152 Pages (5 x 7 1/2 in.).

Price \$1.25

The first eight chapters are discussions of the general principles, and treat of: Train Dispatching, the Dispatcher, the Operator, the Order (with photographic illustrations of very good and very bad manuscripts), the Manifest, the Record, the Train-Order Signal, the Transmission. Chapter Nine contains the standard code of rules for the movement of trains by telegraphic orders, with comments on each rule, giving valuable practical advice as to its application in special cases, and making its purpose and necessity clear. Chapter Ten contains the standard forms of train orders, and the remaining chapters treat of rules as to rights of track, numbering switches, &c. The book is complete and exhaustive as a practical handbook and course of instruction for an inexperienced operator, and there are few superintendents or dispatchers who may not learn much from Mr. Anderson's long experience in this department. He is probably the best authority in the world on train dispatching.

PUBLISHED AND FOR SALE BY

THE RAILROAD GAZETTE, 73 Broadway, New York.

T.

S,

C.

D.,

g

in the
very
L. the
crains
to the
in con-
to the
and the
in the

York.

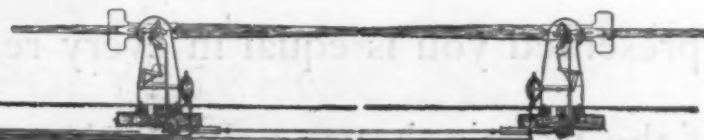
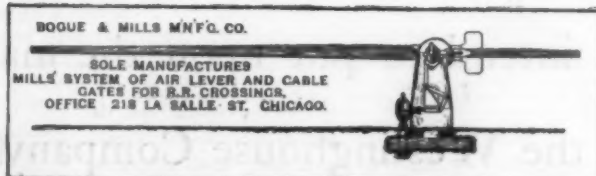
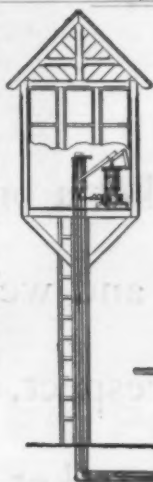
GEORGE M. BOGUE, President. M. B. MILLS, Vice-President. O. A. BOGUE, Sec'y and Treas.

BOGUE & MILLS MANUFACTURING COMPANY,

SOLE MANUFACTURERS.

Of the Roads Extensively Using
Our Gates, We Refer you to the

Chicago & Northwestern;
Chicago, Burlington &
Quincy; Chicago & Western
Indiana; Chicago, Rock
Island & Pacific; Chicago &
Grand Trunk; Illinois Cen-
tral; Chicago & West Michi-
gan; Chicago, St. Louis &
Pittsburgh; Chicago & Alton;
Chicago & Eastern Illinois;
Long Island.



Correspondence Solicited.

Delaware & Hudson Canal
Co.; Pittsburgh, Cincinnati,
Chicago & St. Louis; St.
Louis & San Francisco; Lou-
isville, New Orleans & Texas;
Evansville & Terre Haute
Pittsburgh & Lake Erie;
Pittsburgh, Fort Wayne &
Chicago; Toledo & Ohio Cen-
tral; Baltimore & Ohio; Union
Pacific System; Denver &
Rio Grande.

MILLS SYSTEM OF AIR, LEVER AND CABLE GATES FOR RAILROAD CROSSINGS.

The Mills' Air or Pneumatic Gate is less complicated in its construction than any crossing gate made, therefore less liable to get out of order. The Mills' is the only Air or Pneumatic Gate made that locks its arms down as well as up and that operates its arms together. This is a very essential point to consider, as we can show where accidents have occurred when one arm had come down into position and the other but partly down, thus allowing teams to pass through and under the arm on to the tracks.

OFFICE: 218 LA SALLE STREET, CHICAGO, ILL.

Established 1867.

EDWIN HARRINGTON, SON & CO.

Works and Office
Cor. N. 15th St. & Penn. Av., Philadelphia, Pa., U. S. A.
Manufacturers of a Full Line of

Iron Working Machinery,

INCLUDING
Extension and Gap Lathes, Planers with Quick
Return, Drills, etc., Hand Power Elevators with
Patent Brake, Double Chain Screw Hoists, Over-
head Tramway with Switch, Turntable and
Geared Truck. Send for Estimates.

GEAR CUTTING A SPECIALTY.

EXTENSION LATHE

WIRE ROPE

FOR ALL PURPOSES.

IRON AND STEEL WIRE OF ALL KINDS

TRENTON IRON CO.

NEW YORK OFFICE
COOPER HEWITT & CO
17 BURLING SLIP

TRENTON, N. J.
WIRE ROPE
TRAMWAYS & C

R. CARMAN-COMBES,
President.

THOS. J. SWIFT,
Managing Director.

J. W. LATTIG,
Gen'l Supt. and Treas.

H. S. PFEIL,
Gen'l Agt. and Sig. Engr.

NATIONAL SWITCH & SIGNAL COMPANY

Office and Works: EASTON, PENNA.

—DESIGNERS AND MANUFACTURERS OF—

RAILROAD SAFETY APPLIANCES.

Mechanical and Electrical Interlocking, Electric Block Signals
and Distant Switch Signals.

PLANS MADE AND BIDS SUBMITTED FOR INTERLOCKING TERMINALS, YARDS, JUNCTIONS, GRADE CROSSINGS, DRAW-
BRIDGES, PASSING STATIONS, etc.

SPECIAL APPLIANCES:

Koyls' Parabolic Illuminated Semaphore,

National Torpedo Machine,

M. & S. Double-Wire Compensator,

National Selector,

Adjustable Clamp Pipe Lug.

New York Office: 41 Pine St. Southern Agent: J. A. CHISHOLM, Savannah, Ga.

WESTERN UNION TELEGRAPH OFFICE AT THE WORKS.

TO RAILROAD MANAGERS

We do not intend to put upon the market a brake in any way inferior to that of the Westinghouse Company, and we assert that our system as now presented you is equal in every respect, and superior in some, to that of the Westinghouse now on the market.

We also assert that our Quick Action No. 2 Triple Valves are operated by the Westinghouse Pump, and the Westinghouse Engineers' Valve equally as well as the Westinghouse Quick Acting Triple Valves.

We also assert that our Duplex Pump and Engineers' Valve are decidedly better than the Westinghouse Pump and Engineers' Valve, and will operate either the Westinghouse or the New York Car Brakes to better advantage than the Westinghouse engine equipment.

Competition has not only improved the quality, but reduced the price, and we think, in view of the above facts, that we are entitled to a share of your patronage.

THE NEW YORK AIR BRAKE CO.,

115 BROADWAY, NEW YORK CITY.

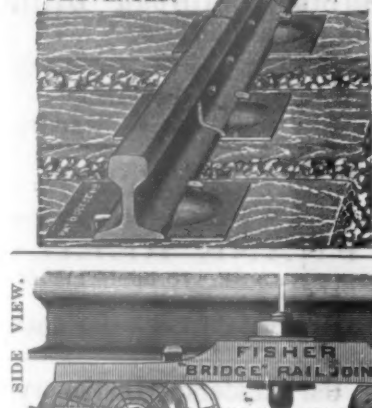
ROYAL C. VILAS, President.

JOHN C. THOMPSON, Secretary and Treasurer.

CHAS. A. STARBUCK, Vice-President.

ALBERT P. MASSEY, Mechanical Engineer.

ACCIDENTS FROM TRACK SPREADING PREVENTED.



THE SHOULDER TIE PLATE

1. Prevents Widening of the Gauge.
2. Prolongs the Life of the Tie.
3. Prevents Cutting at Neck of the Spike.

The rail bearing against the shoulder brings into use the inside as well as the outside of spike, doubles the present resistance to lateral thrust and thus effectually prevents spreading of the track. Especially adapted for use in Yards, at Terminals, and on Curves and Bridges.

THE SHOULDER TIE PLATE is in use on thirteen railroads. Among others, the Norfolk Southern, Central of New Jersey, Louisville & Nashville, Pittsburgh & Western, Long Island, White Electric, etc., etc.

THE SHOULDER TIE-PLATE COMPANY,

GENERAL OFFICE: J. T. STEWART, Sec. and Treas., 1511-1515 N. 31st St., PHILADELPHIA.

BRANCH OFFICES: (SIGOURNEY F. CLARK, 18 Front St., NEW YORK.

(C. I. WICKERSHAM, The Rookery, CHICAGO, ILL.

Send for Circulars and Samples for Trial.

Rail Ends carried directly by the arched beam and screwed DOWN to it with a force of 15,000 lbs.—making practically a continuous rail. Whole surface of beam for support and wear. No breakage of Rails or Joints. No "low joints." No "creeping." No loose nuts. Cost of keeping up track reduced to one-third of that with Angle Bars and giving smoother surface.

ALL OF WROUGHT IRON AND STEEL.

For further information address

FISHER RAIL JOINT WORKS, Trenton, N. J. $\frac{1}{2}$ of Full Size.

RENSSELAER POLYTECHNIC INSTITUTE, TROY, N. Y.

A SCHOOL OF ENGINEERING.

Established 1824.

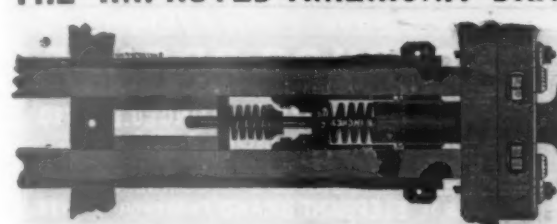
Send for a Catalogue to the Director.

ALPHABETICAL INDEX TO ADVERTISEMENTS.

(Classified Index on the next page.)

Abendroth & Root Mfg. Co.	C. C. C. & St. L. Ry.	Fuller Bros. & Co.	Lima Machine Works.	Pennsylvania Steel Co., N. Y.	Smith, F. H.
Acme Machy. Co.	C. H. & D. Ry.	Gardner, O. K.	Link Belt Engineering Co.	Pennsylvania Steel Co., Pa.	Solid Steel Co.
Adams, Oliver.	C. M. & St. P. Ry.	Kater Iron Works.	Link Belt Machy. Co.	Perry Ventilator Co.	Southern & Co.
Adams & Westlake Co.	C. R. I. & P. Ry.	Gilbert, Bradford	Lodwell Car Wheel Co.	Peters, G. D. & Co.	South Baltimore Car Works.
Alex Metal Co.	Chicago & Alton R. R.	Gill, Alexander E. Mfg. Co.	Long & Alistatter Co.	Philadelphia Bridge Wks.	Southern, Jno. & Co.
Allen Paper Car Wheel Co.	Chicago & N. W. Ry.	Gold Car Heating Co.	Louis, Bridge & Iron Wks.	Phila. Engineer, Wks., Ltd.	Southern & Pac. Refrig. Car Co.
Albion Rolling Mills.	Cleveland City Forge & Iron Co.	Goodwin, J. B.	Louis, Car Wheel & Ry. Sup. Co.	Phillips, William H.	Spon, E. & F. N. & Co.
Allison Mfg. Co.	Cleveland Frog & Cross Co.	Gould Coupler Co.	Louisville Steam Forge Co.	Phoenix Bridge Co.	Sprague, Duncan & Hutchinson
American Car Door Co.	Condon Brake Shoe Co.	Gould & Eberhardt.	Lucus, Albert	Phosph. Br's Smet. Co., Ltd.	Springfield Iron Co.
Amer. Cont. Drawbar Co.	Connelly, J. W. Mfg. Co.	Goulds Mfg. Co.	Lukens Iron & Steel Co.	Pickering Spring Co.	Standard Car Coup Co.
American Fluoride Co.	Copeland & Bacon	Grand Union Hotel.	Males, A. S. & Co.	Pittsburgh Bridge Co.	Standard Nut Lock Co.
Amer. Steel Scraper Co.	Coont. Rail Joint Co. of Amer.	Greenlee Bros. & Co.	Manning, Maxwell & Moore	Pittsburgh Forge & Iron Co.	Standard Paint Co.
American Steel Wheel Co.	Cooke Loco. & Mach. Co.	Guarantee Co., N. A.	Marion Steam Shovel Co.	Pittsburgh Loco. & Car Wks.	Standard Steel Works.
American Washer & Mfg. Co.	Copeland & Bacon	Hale & Kilburn Mfg. Co.	Martin Anti-Fire Car Heat. Co.	Pittsburgh Testing Laboratory.	Standard Thermometer Co.
Anderson & Barr.	Crescent Lums. & Const. Co.	Halsey, Jas. T.	Mechanical Central Ry.	Place, Geo.	Siles & Parker Press Co.
Andrews Paint & Color Co.	Croes, J. J. R.	Hammitt, M. C.	McClure, Alex.	Poege, John N.	Stonington Lbr.
Appleton, Thomas.	Curtis Regulator Co.	Harrington, M. C.	McClure, Alex. & Co.	Porter, H. K. & Co.	Stow Flexible Shaft Co.
Ashcroft Mfg. Co.	Cushion Car Wheel Co.	Hartford Steam Boiler & I. & L. Co.	McGill Iron Works Co.	Portland Co. Wks.	Stow Mfg. Co. & Steel Co.
Ashton Valve Co.	De LaVerne Ref. Mach. Co.	Hartford Woven Wire Mat. Co.	McIntyre Mfg. Co.	Pottsville Bridge Co.	Tait & Carlton.
Austin, F. C. Mfg. Co.	Delaware Car Works.	Harvey Steel Car Co.	Meneely Bearing Co.	Pratt & Letchworth.	Taylor Iron & Steel Co.
Auto Interch. Car Coup. Co.	Detroit Bridge & Iron Wks.	Heller & Brightly.	Michigan Central Ry.	Prindle & Co., H. B.	Taylor, J. L. Mfg. Co.
Baker, Wm. C.	De Vos, F. W. & Co.	Hendricks Bros. & Co.	Michigan Forge & Iron Co.	Queen & Co.	Thompson, J. L. Mfg. Co.
Baltimore Car Wheel Co.	Dickson Mfg. Co.	Hildreth, R. W. & Co.	Middleton, W. S.	R. & C. Co.	Troutwine, Jno. C. Jr.
B. & O. R. R.	Dilworth, Porter & Co.	Hinson Car Coupler Co.	Middleton, W. S.	Rampage Wheel & F. Co.	Troy Car Coupler Co.
Barkly & Hough.	Dixon Crucible Co., Jos.	Hinson Draw Bar Attach.	Midwest Steel Co.	Rand Drill Co.	Union Bridge Co.
Barnes, D. L.	Drake & Wells.	Hoscoe Tunnel Rods.	Missouri Pacific Ry.	Reed, Frank.	Union Iron Works.
Bement, Mills & Co.	Drexel Ry. Supply Co.	Hopkins, D. A. Mfg. Co.	Morse Twist Drill & Mach. Co.	Reich, Paul R. & Co.	Union Switch & Signal Co.
Berlin Iron Bridge Co.	Dudgeon, Richard.	Howson & Howson.	Morton Safety Heating.	Richmond Loco. & M. Wks.	U. S. Metallic Packing Co.
Berry & Orton Co.	East, Gran. Roof Co.	Hunt, C. W. Co. & Co.	Morse Twist Drill & Mach. Co.	Roberts, A. & P. & Co.	Universal Radial Drill Co.
Bethlehem Iron Co.	Eckstein, C. G. & Co.	Hunt, Robt. W. & Co. The	Murphy Varnish Co.	Robinson & Orr.	Valle & Young.
Billing & Spencer Co.	Edge Moor Bridge Works.	Hutchins, C. B. & Sons	Nathan Mfg.	Rodriguez, J. A. L.	Vat, Vernon.
Blackmer & Post.	Egan Co., The	Illinois Central R. R.	Natl. Electric Headlight Co.	Ross, Loco. & Mach. Wks.	Comp. Equip. Co.
Biles, E. W. Co.	Electric Secret Service Co.	Illinois Steel Co.	Natl. Hollow Brake Beam Co.	Ross Valve Co.	Von Schen & Garner.
Bloomington Car Co.	Electric Supply & Mfg. Co.	Industrial Works.	Natl. Lock Washer Co.	Royal Ins. Co.	Vulcan Iron Works (Chicago)
Bogue & Mills Mfg. Co.	Elliot Bridge & Switch Co.	Ingersoll-Sargent Drill Co.	Natl. Malleable Castings Co.	Ross, Bridge & Iron Wks.	Wadwell, J. A. L.
Boston Bridge Works.	Elmira Bridge Co.	Jackson & Sharp Co.	Natl. Safety Signal Co.	Ross Loco. & Mach. Wks.	Wagner Car Door.
Boston & Albany R. R.	Employment	Jackson & Wadlin Mfg. Co.	Natl. Switch & Signal Co.	Ross Valve Co.	Walls Iron Works.
Bowler & Co.	"Engineering News"	Jersey City Wheel Fdy. & M. Co.	Newark Mach. Tool Wks.	Royal Ins. Co.	Wants and For Sale
Boyd Brake Co.	Eno Rail Joint Co.	Johns, H. W. Mfg. Co.	Natl. Safe & Machine Co.	Safety Car Heat. & Light. Co.	Watson Mfg. Co.
Bradley, Osgood & Son.	Ensign Mfg. Co.	Johnson Railroad Signal Co.	Natl. Steel Castings Co.	St. Charles Car Co.	Watson & Stillman
Brill, J. G. & Co.	Erie Car Works.	Johnson Car Coupling Co.	Natl. Steel Castings Co.	St. Louis Car Coupler Co.	Wehn Pavement Co.
Brooks Loco. Wks.	Eureka Cast Steel Co.	Johnston R. R. & S. Co.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Weir, Fred C.
Brown Bros. & Co.	Evans, Geo. A.	Jones, B. M. & Co.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Wellman Iron & Steel Co.
Brown Holst. & Conv. Mach. Co.	Fairbanks, Morse & Co.	Jull Mfg. Co.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Westinghouse Air Brake Co.
Brown & Sharpe Mfg. Co.	Falls Hollow Stay Bolt Co.	Kalamazoo R. R. Velocipede & Car Co.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Wharton R. R. Switch Co.
Buckeye Auto. Car Coup. Co.	Farist Steel Co.	Kelsey Railroad Signal Co.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	White, Jno. A. & Co.
Bucyrus Steam Shovel & Dredge Co.	Fay, J. A. & Co.	Ketcham, C. F. & Co.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Whitney, A. & Sons.
Buda Foundry & Mfg. Co.	Field Water Purifier Co.	Koufel & Esser Co.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Whitton, A. S.
Buffalo Seal & Press Co.	Fisher Rail Joint Works.	Keystone Bridge Co.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Whittlesey, Geo. F.
Burkhardt's, Geo. J. Son.	Fitchburg Landing Mach. Co.	Knight Steel Works.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Wilson Bros. & Co.
Bush Cold Guard Co.	Fitzgerald, R. C.	Laidlaw & Dunn Co.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Wilson, Jas. G.
Butler Drawbar Attach. Co.	Flagg, Stanley G. & Co.	L. S. & M. S. R. R.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Wisconsin Central R. R.
Tabell, L. Breckinridge.	Flood & Conklin.	Lee Composite Mfg. Co.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Wolhaupter, Benj.
Cambridge Iron Co.	Fountain Crossing Co.	Lehigh Valley R. R.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Wood, R. D. & Co.
Canda Mfg. Co.	Fowler, Geo. L.	Lidgerwood Mfg. Co.	Natl. Steel Castings Co.	St. Louis Loco. Wks.	Worthington, Henry R.
Canning, E. & Co.	French Spring Co., A.		Natl. Steel Castings Co.	St. Louis Loco. Wks.	Worthington, Henry R.
Car Ventilator Co.			Natl. Steel Castings Co.	St. Louis Loco. Wks.	Worthington, Henry R.
Cayuta Wheel & Fdy. Co.			Natl. Steel Castings Co.	St. Louis Loco. Wks.	Worthington, Henry R.
Chester Steel Castings Co.			Natl. Steel Castings Co.	St. Louis Loco. Wks.	Worthington, Henry R.
Chicago Bridge & Iron Co.			Natl. Steel Castings Co.	St. Louis Loco. Wks.	Worthington, Henry R.
C. B. & Q. R. R.			Natl. Steel Castings Co.	St. Louis Loco. Wks.	Worthington, Henry R.

THE IMPROVED AMERICAN DRAFT AND BUFFING APPARATUS.



It is a fact that it saves over 90 per cent. in repairs to Draft-Rigging, and is in use in more cars and more miles of Railroad and private car companies than all others combined. Send for drawing and references to Company's office.

AMERICAN CONTINUOUS DRAW-BAR CO. (SOLE OWNERS), AURORA, IND.

THE WEIR FROG CO.
CINCINNATI, O.
FRED C. WEIR, PRES.

SOLE MANUFACTURERS OF
FRED C. WEIR'S
IMPROVED RIGID & SPRING FROGS, CROSSINGS
SINGLE & THREE THROW SPLIT SWITCHES.
FIXED & AUTOMATIC SWITCH STANDS, STEEL
DIE FORMED RAIL BRACES, SWITCH FIXTURES, ETC.

CABLE & ELECTRIC
TRACK WORK
FROGS, SWITCHES
CROSSINGS, CURVES
RAIL CHAIRS
ETC.

P. & B.
WATERPROOF INSULATING PAPERS
FOR
REFRIGERATOR CARS.
Largely Used and Endorsed by the
LARGEST CONSUMERS IN THE WORLD.

ESTABLISHED 1884.
CHARLES F. KETCHAM & CO.
27 & 29 NASSAU ST. NEW YORK,
RAILROAD PRINTERS & STATIONERS
KEEP IN STOCK OF MOST APPROVED FORMS
BOOKS FOR STATION AND TRAIN USE.
BAGGAGE RECORD, CASH, FRT. CONDUCTOR'S CAR LIST,
FRT. FORWARDED, FRT. RECEIVED, MANIFEST COPYING,
TEL. TRAIN ORDER, &c., &c.
PAPER AND BOOKS FOR
ENGINEERS AND CONTRACTORS USE.
BLUE PROCESS, FIELD, QUANTITY, TRADING,
CROSS SECTION, LEVEL, PROFILE, TRANSIT,
DETAILED EST., TIME, PAY ROLL, TOPOG.,
MO. RETURN, DRAWING, WAGES TABLE, &c., &c.
PRINT, RULE AND BIND IN ANY QUANTITY
BLANKS AND BOOKS FOR RAILROADS,
AND KEEP STATIONERY FOR ALL.
YOUR ORDERS OR CORRESPONDENCE SOLICITED.

THE JOHN A. WHITE CO.
DOVER, N.H.
MANUFACTURERS
OF STANDARD WORKING
WOODWORKING MACHINERY

ENGINEER'S AND FIREMAN'S TIME, EXPENSE, AND MEMORANDUM ACCOUNT BOOK.

DESIGNED AND COPYRIGHTED BY E. W. YATES.

A pocket memorandum book with rubber-tipped pencil attached, with calendar and pages most conveniently arranged for the engineer or fireman to keep his own daily record of time and miles run, rate and amount earned; also for individual expense account each month and for general memoranda. A certain method of checking with the timekeeper in case of disagreement. It lasts one year, and every engineer and fireman should have one. Price, 50 cents each; \$20.00 for fifty copies, or \$35.00 a hundred. An agent wanted on each road.

PUBLISHED AND FOR SALE BY

THE RAILROAD GAZETTE,

73 Broadway, New York.



Portable Railroad Drill.

ALSO USEFUL FOR

Bridge Builders.
Cable Road Builders,
Structural Iron Workers.

SAVES TIME AND LABOR.

Write for circulars and full information

FRANK REED,
19 Hermon St., Worcester, Mass.

BRYANT & BARBEY, New England Agents
178 Summer St., Boston.

New Revised Edition of Car-Builders' Dictionary.

THE RAILROAD GAZETTE, 73 Broadway, New York.

RAILROAD GAZETTE DIRECTORY: CLASSIFIED ADVERTISEMENTS.

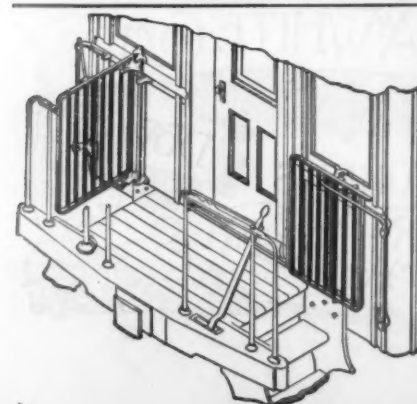
- Air Brake Fittings**
Stanley G. Fisk & Co., Phila.
- Air Brake Hose**
N.Y. Belt & Pack Co., Ltd., 15 Park Row.
- Air Brake Regulator**
Marion Regulator Co., Boston.
- Air Compressors & Rock Drills**
Ingersoll-Sergeant Rock Drill Co., 10 Park Place, N.Y.
- Architects**
Bradford L. Gilbert, 50 Broadway, N.Y.
Thomas Appleton, 305 Rialto Bldg., Chic.
- Architectural Iron Work**
King Bridge Co., Cleveland, O.
- Asbestos Packing**
H. W. Johns Mfg. Co., N.Y. City.
- Asphalt Pavement**
Wehn Pavement Co., 16 E. 14th St., N.Y.
- Axles**
Cambria Iron Co., Johnstown, Pa.
Lima Machine Works, Lima, Pa.
Louisville Steam Forge Co., Louisville, Ky.
Mich. Forge & Iron Co., Detroit, Mich.
Midvale Steel Co., Nicetown, Pa.
Pittsburgh Forge & Iron Co., Pittsb., Pa.
T. Prosser & Son, 15 Gold St., N.Y.
- Balanced Slide Valves**
M. C. Hammett, Troy, N.Y.
- Railroad Unloaders**
Marion Steam Shovel Co., Marion, O.
- Bankers**
Brown Bros. & Co., 59 Wall Street, N.Y.
- Bel Cord & Couplings**
Samson Cordage Works, Boston, Mass.
- Belters**
Abendroth & Root Mfg. Co., 28 Cliff St., N.Y.
Lidgerwood Mfg. Co., 96 Liberty St., N.Y.
Rich. Loco. & Mach. Co., Richmond, Va.
- Boiler Plate**
Schoenberger & Co., Pittsburgh, Pa.
- Boiler Unloaders**
Wellman Iron & Steel Co., Thurlow, Pa.
- Bolt Cutters**
Acme Machinery Co., Cleveland, O.
Howard Iron Works, Buffalo, N.Y.
- Bolts & Nuts**
Fuller Bros. & Co., 128 Greenwich St., N.Y.
Rhode Island Tool Co., Providence.
- Books & Publications**
E. & F. N. Spon. & Co., 12 Cortlandt St., N.Y.
John C. Trautwine, Jr.
- Brake Adjusters**
Blackley Brake Co., Trenton, N.J.
Q. & C. Co., Chicago.
- Brake Beams**
Nat. Hollow Brake Beam Co., Chic., Ill.
Northwestern Equipment Co., Chicago.
- Brake Shoes**
Schoen Mfg. Co., Pittsburg.
- Brakes**
Boyd Brake Co., Baltimore, Md.
Westinghouse Air-Brake Co., Pittsb., Pa.
- Brake-Shoes**
Congdon Brake-Shoe Co., Chicago, Ill.
Ramapo (N.Y.) Wheel & Foundry Co.
- Bridges**
Anderson & Barr, Jersey City, N.J.
Berlin Iron Bridge Co., E. Berlin, Conn.
Boston Bridge Works, Boston, Mass.
Chicago Bridge & Iron Co., Chicago, Ill.
Croford & Saylor, Philadelphia, Pa.
Detroit Bridge & Iron Wks., Det., Mich.
Edgemoor Bridge Wks., Wilmington, Del.
Elmira Bridge Co., Elmira, N.Y.
S. W. Prescott, World Bldg., N.Y.
Keystone Bridge Co., Pittsburgh, Pa.
King Bridge Co., Cleveland, O.
Louisville Bridge & Iron Co., Louisville, Ky.
Mo. Val. Br. & Ir. Wks., Leavenworth, Kan.
Mt. Vernon Bridge Co., Mt. Vernon, O.
New Jersey Steel & Iron Co., Trenton.
Passaic Rolling Mill, Paterson, N.J.
Phoenixville Bridge Co., Phila., Pa.
Pittsburgh Bridge Co., 1105 Owings Bldg., Chicago.
Pottsville Bridge Co., Phila.
- Rochester Bridge & Tr. Wks.**
Rochester A. & P. Roberts & Co., Philadelphia, Pa.
San Francisco Bridge Co., California.
Shaller & Schnigau, Chicago, Ill.
Shaffer Bridge Co., Pittsburgh, Pa.
Soy Smith & Co., 2 Nassau Street, N.Y.
Union Bridge Co., 15 Broadway, N.Y.
J. A. L. Waddell, Kansas City, Mo.
Wallis Iron Works, Jersey City, N.J.
Youngstown (Ohio) Bridge Co.
- Bridge Machinery**
Vulcan Iron Works, Chicago.
- Bridge Timbers**
Alexander McClure, Pittsburgh, Pa.
- Buildings**
Berlin Iron Bridge Co., E. Berlin, Conn.
- Buildings**
Williams, White & Co., Moline, Ill.
- Cars**
Allison Mfg. Co., Philadelphia, Pa.
Bloomington Car Co., Bloomington, Pa.
Osmond Bradley & Sons, Worcester, Mass.
J. G. Brill & Co., Philadelphia, Pa.
Canda Mfg. Co., 11 Pine St., N.Y.
Reginald Canning & Co., 115 E. 14th St., N.Y.
Eugene Mfg. Co., Huntington, West Va.
Erie Car Works (Limited), Erie, Pa.
Harvey Steel Car Co., Chicago, Ill.
Jackson & Sharp Co., Wilmington, Del.
Jackson & Woodill Mfg. Co., Berwick, Pa.
A. S. Males & Co., Cincinnati.
- Midletown Car Wks.**
Midletown Car Wks., Middletown, Pa.
N.Y. Equipment Co., 15 Wall St., N.Y.
R. M. Pancost, Camden, N.J.
Pardee Car & Mach. Wks., Watertown, Pa.
Portland Car Co., Portland, Me.
Sammamish Car Works, Baltimore, Md.
St. Charles Car Co., St. Charles, Mo.
Wagon Mfg. Co., Springfield, Mass.
Youngstown (Ohio) Car Mfg. Co.
- Cars, Second Hand**
Reginald Canning & Co., 115 E. 14th St., N.Y.
A. S. Males & Co., Cincinnati.
- N.Y. Equipment Co.**
N.Y. Equipment Co., 15 Wall St., N.Y.
- Car Couplings**
Auto. Interchangeable Car Coupler Co., San Francisco, Cal.
Buckeye Aut. Car Coupler Co., Columbus, O.
Drexel Car Coupler Co., Roanoke, Va.
Gould Coupler Co., Buffalo, N.Y.
Hinson Car Coupler Co., Chicago, Ill.
Johnston Car Coupler Co., Phila., Pa.
McConway & Torley Co., Pittsburgh, Pa.
McGill Iron Works Co., Peoria, Ill.
Parr & Letchworth, Buffalo, N.Y.
St. Louis Car Coupler Co., St. Louis, Mo.
Smillie Coupler & Mfg. Co., Newark, N.J.
The Standard Car Coupler Co., Troy, N.Y.
Trojan Car Coupler Co., Troy, N.Y.
Van Dornen Coupler Co., Phila., Pa.
- Car Doors**
Amer. Car Door Co., Indianapolis, Ind.
Q. & C. Co., Chicago, Ill.
Wagner Car Door Co., Indianapolis, Ind.
- Car Heaters**
Baker Heater Co., 739 Greenwich St., N.Y.
Consol. Car Heating Co., Albany, N.Y.
Gold Car Heat Co., Frankfort St., N.Y.
Martin A. F. Car-Heat Co., Dunkirk, N.Y.
Morton Safety Heating Co., Chicago.
National Car Heating Co., Chicago.
Railroad Lighting & Mfg. Co., Phila., Pa.
Safety Car H. & Light Co., 100 E. 14th St., N.Y.
- Car Heating Equipment**
Stanley G. Fisk & Co., Philadelphia.
- Car Machinery**
Greenlee Bros. & Co., Chicago.
- Car Platform Gates**
J. B. Goodwin, 25 E. 14th St., N.Y.
- Car Plushes**
Sanford Mills, 129 Wash'n St., Boston.
- Car Repairing**
Q. & C. Co., Chicago.
- Car Roofing**
Drake & Wells, Cleveland, O.
E. Hutton's Sons, Detroit.
Lee Composite Mfg. Co., New York.
- Car Seals**
Buffalo Seal & Press Co., Buffalo, N.Y.
- Car Seats**
Hartford Woven Wire Mattress Co., Hartford, Conn.
- Car Upholstering**
Hale & Kilburn Mfg. Co., Phila.
- Car Wheel Presses**
Davenport & Fairbairn, Erie, Pa.
Knitted Mattress Co., Canton Jet, Mass.
- Car Wheels**
Allen Paper Car Wheel Co., Chicago, Ill.
American Steel Wheel Co., N.Y. City.
Baltimore Car Wheel Co., Balto., Md.
Bowler & Co., Cleveland.
Caryus Wheel & Foundry Co., Sayre, Pa.
Cushion Car Wheel Co., Indianapolis.
Lima Machine Works, Lima, O.
Dickson Car Wheel Co., Houston, Tex.
C. G. Eckstein & Co., 22 Liberty St., N.Y.
Jersey City Wheel & Mach. Works.
Lima Machine Works, Lima, O.
Lobdell Car Wheel Co., Wilmington, Del.
Louis Car Wheel Co., Louisville, Ky.
N.Y. Car Wheel Works, Buffalo.
The Prosser & Son, 15 Gold Street, N.Y.
Ramapo Wheel & Dry Co., Ramapo, N.Y.
Stand. Steel Wks., 220 So. 4th St., Phila.
Taylor Iron & Steel Co., High Bridge, N.J.
Washington Car Wheel Co., Hartford, Conn.
Wagon Mfg. Co., Springfield, Mass.
- Whitney & Sons, Philadelphia, Pa.**
N.Y. Equipment Co., 15 Wall St., N.Y.
O. K. Gardner, Box 171, Pittsburgh, Pa.
- Castle Guards**
Bush Castle Guard Co., Kalamazoo, Mich.
Kalamazoo R. R. Veloc. & Car Co., Kalamazoo, Mich.
Wolbach, Benj., 33-43 Washington St., Chicago, Ill.
- Castles**
Pittsb. Testing Laboratory, Pittsb., Pa.
- Cast Chute**
Williams, White & Co., Moline, Ill.
- Car Transferring**
C. W. Hunt Co., 65 Broadway, New York.
- Consulting Engineers**
D. L. Barnes, The Rookery, Chicago.
J. J. R. Cross, 18 William St., N.Y.
S. W. Prescott, World Bldg., N.Y.
Geo. L. Fowler, 38 Broadway, N.Y.
Albert Lucius, 71 Broadway, N.Y.
W. B. Parsons, 35 Broadway, N.Y.
Chas. Faine & Sons, 71 Broadway, N.Y.
F. H. Smith, 27 E. German St., Balto., Md.
Von Schen & Garrer, Frederick, Md.
- Consulting Electrical Engineers**
Sprague, Duncan & Hutchinson, N.Y.
- Conveyers**
Link Belt Eng. Co., Nicetown, Phila.
- Copper**
Hendricks Bros., 49 Cliff Street, N.Y.
- Cordage**
Samson Cordage Works, Boston, Mass.
- Cranes**
Industrial Works, Bay City, Mich.
John N. Foage, Cincinnati, O.
Hendrick & Co., Philadelphia, Pa.
Yale & Towne Mfg. Co., Stamford, Conn.
- Crescenting**
Crescent Crane & Construction Co., Fernandina, Fla.
Lehigh Valley Creo. Wks., P. Amboy, N.J.
- Crossings**
Pontiac Crossing Co., Detroit, Mich.
- Crossing Gates**
Bogue & Mills Mfg. Co., Chicago.
- Culvert Pipe**
Blackmer & Post, St. Louis, Mo.
- Draft Rigging**
Schoen Mfg. Co., Pittsburgh, Pa.
- Drawbar Attachments**
Amer. Cont. Draw Bar Co., Aurora, Ill.
American Steel Wheel Co., N.Y. City.
- Butler Drawbar Attach. Co.**
Cleveland.
Hinson Drawbar Attach. Co., Chicago.
- Dredging Machinery**
Bucyrus (O.) Steam Shovel & Dredge Co., San Francisco Bridge Co., California.
Vulcan Iron Works, Chicago.
- Drop Serrings**
Billings & Spencer Co., Hartford, Conn.
- Electric Crossing Signal**
Electric Supply & Mfg. Co., Cleveland, O.
- Electric Headlights**
Nat. Elect. Headlight Co., Indianapolis.
- Elevators**
Link Belt Eng. Co., Nicetown, Phila.
- Emery Wheels**
N.Y. Belt & Pack Co., Ltd., 15 Park Row.
Northampton Emery W. Co., Leeds, Mass.
- Engineering Employment Bureau**
Engineer. Employ'm't Bureau, 8 Granger Block, Syracuse, N.Y.
- Engineering Instruments**
Chas. H. Brightly, Philadelphia, Pa.
Heller & Brightly, Philadelphia, Pa.
Geo. L. Fowler, 38 Broadway, N.Y.
C. F. Ketcham & Co., 27 Nassau St., N.Y.
Keuffel & Esser, New York City.
- Engines**
Thomas Appleton, 305 Rialto Bldg., Chic.
J. L. Barnes, The Rookery, Chicago.
J. J. R. Cross, 18 William St., N.Y.
S. W. Prescott, World Bldg., N.Y.
Geo. L. Fowler, 38 Broadway, N.Y.
Albert Lucius, 71 Broadway, N.Y.
W. B. Parsons, 35 Broadway, N.Y.
Chas. Faine & Sons, 71 Broadway, N.Y.
F. H. Smith, 27 E. German St., Balto., Md.
Von Schen & Garrer, Frederick, Md.
- Explosives**
Hendrick Powder Co., 23 Park Place, N.Y.
- Feed-Water Purifier**
Field and Art. Purifier Co., Chicago.
- Fences**
Barkly & House, Chicago, Ill.
- Flexible Shafting**
New Flexible Shaft Co., Phila., Pa.
Stow Mfg. Co., Binghamton, N.Y.
- Floors**
The Foss Mfg. Co., Springfield, O.
- Frogs and Crossings**
Allentown Rolling Mill, Allentown, Pa.
Cleveland (O.) Frog & Crossing Co.
Elliott Frog & Sw. Co., E. St. Louis, Ill.
Johnston R. R. Frog & Switch Co., Phila.
Pittsburgh Bridge Co., Phila., Pa.
Ramapo Iron Works, Hillburn, N.Y.
Union Switch & Signal Co., Pittsburgh.
Weir Frog Co., Cincinnati, O.
- Furnaces**
Abendroth & Root Mfg. Co., 28 Cliff St., N.Y.
- Gauges (Pressure)**
Askerott Mfg. Co., 111 Liberty St., N.Y.
- Graders, Ditchers & H. Builders**
F. C. Austin Mfg. Co., Chicago, Ill.
- Guarantee Co.**
Guarantee Co. of N. A., Montreal.
- Hand Cars**
The Budd Fdy & Mfg. Co., Harvey, Ill.
Fairbanks, Morse & Co., Chicago.
Kalamazoo (Mich.) R. R. Veloc. Co.
Sheffield Velocipede Car Co., Three Rivers, Mich.
- Harbor Works**
S. W. Prescott, World Bldg., N.Y.
- Highway Crossing Signals**
Electric Supply & Mfg. Co., Cleveland, O.
- Holding & Conveying Machinery**
Brown Holding & Conveying Mach. Co., Cleveland, O.
- C. W. Hunt Co.**
45 E. 14th St., New York.
- King Bridge Co.**
Cleveland, O.
- Lidgerwood Mfg. Co.**
96 Liberty St., N.Y.
- Link Belt Machinery Co.**
Chicago, Ill.
- Hoisting Engines**
Copeland & Bacon, New York City.
Industrial Works, Bay City, Mich.
Lidgerwood Mfg. Co., 96 Liberty St., N.Y.
- J. S. Mundy, Newark, N. J.**
Vulcan Iron Works, Chicago.
- Hollow Way Bolt Iron**
Falls Hollow Stay Bolt Co., Cuyahoga Falls, O.
- Hydraulic Jacks**
Richard Dudgeon, 24 Columbia St., N.Y.
Joseph F. McCoy Co., 28 Warren St., N.Y.
Watson & Stillman, 210 E. 43d St., N.Y.
- Hydraulic Machinery**
Thos. Olsen & Co., Philadelphia, Pa.
Union Iron Works, San Francisco.
Watson & Stillman, N.Y. City.
R. D. Wood & Co., Philadelphia, Pa.
- Inspectors**
Nathan Mfg. Co., 84 Liberty Street, N.Y.
- Inspectors of Bridges and Mfg. Equipment**
Pittsb. Test. Laboratory, Pittsb., Pa.
- Wm. Sellers & Co., Philadelphia.**
R. W. Hildreth & Co., 2 Wall St., N.Y.
- Insurance**
Hart, S. Diller Insur. & Ins. Co., Hartford.
Royal Ins. Co., 30 Wall Street, N.Y.
- Interlocking Switches & Signals**
Allentown Rolling Mill, Allentown, Pa.
Hill Signal Co., 50 E. 14th St., N.Y.
Kelley R. R. Signal Co., Florence, Mass.
Nat. Switch & Signal Co., So. Bethlehem, Pa.
- Iron-Work for Contractors**
Edgemoor Bridge Wks., Wilmington, Del.
King Bridge Co., Cleveland, O.
- Iron & Steel Ship Builders**
Union Iron Works, San Francisco.
- Jacks**
Fairbanks, Morse & Co., Chicago.
McSherry Mfg. Co., Dayton, O.
Richard Dudgeon, 24 Columbia St., N.Y.
Watson & Stillman, 210 E. 43d St., N.Y.
- Journal Bearings**
Alx Metal Co., Philadelphia, Pa.
D. A. Hopkins Mfg. Co., 143 Liberty St., N.Y.
- Phosphor-Bronze Smelting Co., Phila.**
Paul S. Reeves, Philadelphia, Pa.
- Journal Bearings-Tubular**
Meneely Bearing Co., W. Troy, N.Y.
- Journals**
Hess Lida.
Ramapo (N.Y.) Wheel & Dry Co.
- Lighting**
Adams & Westlake Co., Chicago.
Railroad Lighting & Mfg. Co., Phila., Pa.
Safety Car Heat & Light Co., 100 E. 14th St., N.Y.
- Link Belting**
Link Belt Eng. Co., Nicetown, Phila.
- Loose Washers**
Nat. Lock Washer Co., Newark, N.J.

FLUORIDE SCALE
In Boilers
PREVENTED BY
FLUORIDE.

AMERICAN FLUORIDE COMPANY,
126 Liberty Street, New York. Western Office, 73 & 75 W. Jackson Street, Chicago, Ill.

WILL SEND YOU CIRCULAR AND SAMPLE.

Blown Off the Cars.



This cannot happen to passengers
where cars are equipped
with the

WOOD PLATFORM GATE.

4,000 NOW IN USE.

J. B. GOODWIN, Sole Agent
29 Broadway, New York.

Manufactured by R. BLISS MFG. CO.
PAWTUCKET, R. I.

PHOSPHOR-BRONZE
INGOTS, CASTINGS, WIRE, SHEET & C.
THE PHOSPHOR-BRONZE SMELTING CO. LIMITED
512 ARCH ST. PHILADELPHIA PA. U.S.A.
ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND SOLE MAKERS OF "ELEPHANT BRAND" PHOSPHOR-BRONZE.

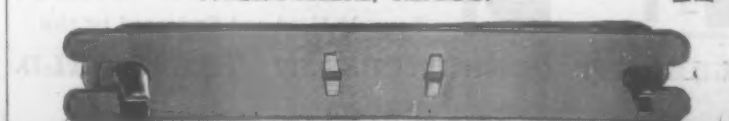
THOMSON'S SLOTTED RIVETS.

The only rivet in the world that can be set without a machine.

For fastening Belts, Straps and other articles made of Leather, Rubber, Canvas, Felt, Pasteboard, Sheet Iron or Wood.

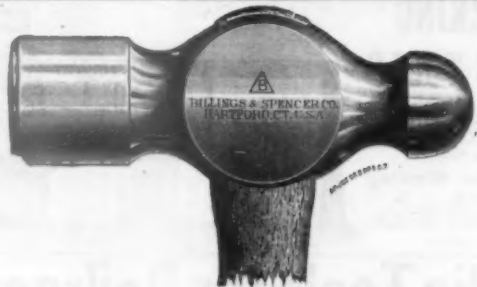
SIZES $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, No. 9 Wire Gauge.
SIZES $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, No. 6 Wire Gauge.

JUDSON L. THOMSON MFG. CO.,
WALTHAM, MASS.



Malleable-Iron, Cast-Iron, Wrought-Iron and Steel Fittings
FOR WROUGHT-IRON PIPE.
Keystone Soft-Metal Union.

Ready for immediate use. Requires no washer. Can be made tight with but little pressure.



SIZES: $\frac{1}{4}$ - $\frac{3}{4}$ - $1\frac{1}{4}$ - $1\frac{1}{2}$ LB.

STANLEY G. FLAGG & CO.,
Nineteenth St., Penna. Ave. and Hamilton St., Philadelphia, Pa.

MANUFACTURERS OF
STEEL AIR-BRAKE FITTINGS.
Guaranteed air-tight, threads full and sharp, made from templates to standard gauge.
SPECIFY
FLAGG STEEL FITTINGS
FOR AIR-BRAKE CONNECTIONS.

BALL PENE
MACHINISTS' HAMMERS,
DROP FORGED FROM BEST TOOL STEEL.

IN MATERIAL, DESIGN, TEMPER AND FINISH, THEY ARE UNEQUALLED.

THE BILLINGS & SPENCER COMPANY,
HARTFORD, CONN.

RAILROAD GAZETTE DIRECTORY CLASSIFIED ADVERTISEMENTS

- Locomotives**
Baldwin Locomotive Works, Philad.
Brooks Locomotive Works, Dunkirk, N.Y.
Cooke Loco. & Mach. Co., Paterson, N.J.
Dickson Mfg. Co., Scranton, Pa.
G. L. Fowler, 58 Broadway, N.Y.
Lima Machine Works, Lima, O.
A. S. Males & Co., Cincinnati, O.
N. Y. Equipment Co., 15 Wall St., N.Y.
Pittsburgh Loco. & Car Wks., Pittsburgh.
R. K. Porter & Co., Pittsburgh, Pa.
Portland Co., Portland, Me.
Richmond (Va.) Loco. & Mach. Works.
Rogers Loco. & Mach. Wks., Paterson, N.J.
Scheneectady (N.Y.) Loco. Works.
Taite & Carlton, London, Eng.
Wharton R. R. Switch Co., Phila.
- Locomotive Boiler Tubes**
Allison Mfg. Co., Philadelphia, Pa.
- Locomotive Finishing Varnish**
Flood & Conklin, Newark, N.J.
- Locomotive Headlights**
Adams & Westlake Co., Chicago.
Nat. Elect. Headlight Co., Indianapolis.
- Locomotive Second-Hand**
Reginald Canning & Co., 115 B'way, N.Y.
A. S. Males & Co., Cincinnati, O.
N. Y. Equipment Co., 15 Wall St., N.Y.
- Locomotive Staybolt Iron**
Falls Hollow Staybolt Co., Cuyahoga Falls, O.
- Lubricators**
Detroit Lubricator Co., Detroit, Mich.
Nathan Mfg. Co., 92 Liberty street, N.Y.
- Machinists' Tools**
Acme Machy. Co., Cleveland, O.
Bement, Miles & Co., Philadelphia, Pa.
Billings & Spencer Co., Hartford, Conn.
E. W. Bliss Co., Brooklyn, N.Y.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ferracute Machine Co., Bridgeton, N.J.
Gould & Eberhardt, Newark, N.J.
Edw. Harrington, Son & Co., Phila.
Hayes Tool Co., Portland, Me.
Long & Allistatter Co., Hamilton, O.
Manning, Max. & Moore, 111 Liberty St.,
Morris Tool Dr. & Mach. Co., N. Bedford, Mass.
Newark Mach. Tool Wks., Newark, N.J.
Niles Tools Works, Hamilton, O.
Pedrick & Ayer, Philadelphia, Pa.
Geo. Place, 120 Broadway, N.Y.
D. Saunders' Sons, Yonkers, N.Y.
Wm. Sellers & Co., Philadelphia, Pa.
Stiles & Parker Press Co., Middletown, Conn.
Stow Flexible Shaft Co., Phila., Pa.
Stow Mfg. Co., Binghamton, N.Y.
Universal Radial Drill Co., Cincinnati.
Watson & Stillman, 210 E. 63d St., N.Y.
Wharton R. R. Switch Co., Phila.
- Malleable Iron Castings**
National Malleable Castings Co., Cleveland, O.
- Mandrel Rolled Staybolt Iron**
Falls Hollow Staybolt Co., Cuyahoga Falls, O.
- Mining Machinery**
Lidgerwood Mfg. Co., 96 Liberty St., N.Y.
Union Iron Works, San Francisco.
- Nut Locks**
Amer. Washer & Mfg. Co., Newark, N.J.
Metcalfe, Paul & Co., Pittsburgh, Pa.
National Lock Washer Co., Newark, N.J.
Ruffner & Dunn, Philadelphia, Pa.
Standard Nut Lock Co., N.Y.
- Oil**
Signal Oil Works, Ltd., Franklin, Pa.
- Oil Cans**
Adams & Westlake Co., Chicago.
- Orre Handling Machinery**
King Bridge Co., Cleveland, O.
Lidgerwood Mfg. Co., 96 Liberty St., N.Y.
- Packing, Asbestos**
H. W. Johns Mfg. Co., N. Y. City.
- Packing, Metallic**
U. S. Metallic Packing Co., Phila.
- Packing, Rubber**
N. Y. Belt & Pack. Co., Ltd., 15 Park Row, N.Y.
- Paint**
Andrews Paint & Color Co., 15 Cortlandt street, N.Y.
F. W. Devos & Co., Fulton St., N.Y.
Jos. Dixon Crucible Co., Jersey City, N.J.
Nat. Paint Works, Williamsport, Pa.
Standard Paint Co., 2 Liberty St., N.Y.
- Patents**
A. C. Fitzgerald, Washington, D.C.
Howson & Howson, 119 So. 4th St., Phila.
Geo. F. Whittlesey, Washington, D.C.
- Phosphor-Bronze**
Paul S. Reeves, Philadelphia.
- Phosphor-Bronze Smelting Co., Phila.**
- Pile Drivers**
Bucyrus (O.) Steam Shovel & Dredge Co.
Industrial Works, Bay City, Mich.
Lidgerwood Mfg. Co., 96 Liberty St., N.Y.
Vulcan Iron Works, Chicago, Ill.
- Pipe Cutting & Threading Mach.**
D. Saunders' Sons, Yonkers, N.Y.
- Pneumatic Foundations**
S. W. Frosch, World Bldg., N.Y.
- Portable Drills**
Jas. T. Halsey, Philadelphia, Pa.
Frank Reed, Worcester, Mass.
Stow Flexible Shaft Co., Phila., Pa.
Stow Mfg. Co., Binghamton, N.Y.
- Pressed Steel**
Schoen Mfg. Co., Pittsburgh, Pa.
- Pumps**
Fairbanks, Morse & Co., Chicago.
Laidlaw & Dunn Co., Cincinnati, O.
R. D. Wood & Co., Philadelphia, Pa.
H. R. Worthington, 86 Liberty St., N.Y.
- Radial Taps**
J. T. Connelly, Milton, Pa.
- Rails**
Bethlehem Iron Co., 90 Broadway, N.Y.
Cambria Iron Co., Johnstown, Pa.
Geo. A. Evans, 40 and 42 Wall St., N.Y.
Humphreys & Sayce, 10 Wall St., N.Y.
Illinois Steel Co., Chicago, Ill.
A. S. Males & Co., Cincinnati, O.
N. Y. Equipment Co., 15 Wall St., N.Y.
Pennsylvania Steel Co., 2 Wall St., N.Y.
Robinson & Orr, Pittsburgh, Pa.
A. S. Whiton, 115 Broadway, N.Y.
- Rail Fastenings**
Cambria Iron Co., Johnstown, Pa.
Fisher Rail-Joint Works, Trenton, N.J.
A. S. Males & Co., Cincinnati, O.
Metcalfe, Paul & Co., Pittsburgh, Pa.
National Lock Washer Co., Newark, N.J.
N. Y. Equipment Co., 15 Wall St., N.Y.
Morris Sellers & Co., Chicago.
Ruffner & Dunn, Philadelphia, Pa.
- Rail Joints**
Cont. Rail Joint Co. of Amer., New York, N.Y.
Eno Rail Joint Co., Newark, N.J.
Fisher Rail Joint Works, Trenton, N.J.
A. S. Males & Co., Cincinnati, O.
McConway & Torrey Co., Pittsburgh, Pa.
Pennsylvania Steel Co., Steelton, Pa.
Q. & C. Co., Chicago, Ill.
- Railroad and Transp. Lines**
Big Four.
Boston & Albany.
Chicago & Alton.
- Chicago, Burlington & Quincy.
Chicago & Milwaukee & St. Paul.
Chicago & Northwestern.
Chicago, Rock Isl. & Pacific.
C. H. & D.
Hoosier Tunnel Route.
Illinois Central.
Lehigh Valley R.R.
Michigan Central.
Missouri Pacific.
New York Central & Hudson River.
New York, Lake Erie & Western.
New York & New England R.R.
Pennsylvania.
Stonington Line.
- Railroad Printing**
C. F. Ketchum & Co., 27 Nassau St., N.Y.
- Railroads, Building & Equipping**
L. Breckinridge Cabell, 55 B'way, N.Y.
- Railroad Supplies**
Bryant & Barney, 25 Milk St., Boston.
Reginald Canning & Co., 115 B'way, N.Y.
Fairbanks, Morse & Co., Chicago.
E. S. Greeley & Co., 7 Day St., N.Y.
The Johnson R. R. Signal Co., B'way.
A. S. Males & Co., Cincinnati, O.
N. Y. Equipment Co., 15 Wall St., N.Y.
G. D. Peters & Co., London, England.
A. T. Shoemaker, Chicago and N.Y.
- Rail Saws**
Bryant & Barney, 175 Summer St., Boston.
- Railway Varnishes & Surfaces**
Flood & Conklin, Newark, N.J.
- Ratchet Drills**
Billings & Spencer Co., Hartford, Conn.
- Reducing Valves**
Curtis Regul. Co., 89 Beverly St., Boston.
Mason Regulator Co., Boston, Mass.
- Refined Iron**
Falls Hollow Staybolt Co., Cuyahoga Falls, O.
- Refrigerator Cars**
R. M. Hancock, Camden, N.J.
Bo. & Pac. Refrigerator Car Co., Chicago.
- Refrigerating Machinery**
De La Vergne Refrig. Machine Co., N.Y.
River, N.Y.
J. A. Thomson Mfg. Co., Waltham, Mass.
- Road Scrapers**
Amer. Steel Scraper Co., Sidney, O.
- Rock Rails and Rock Breakers**
Gates Iron Works, Chicago, Ill.
- Rock Drills**
Ingersoll-Sergeant Rock Drill Co., N.Y.
Rand Drill Co., 22 Park Place, New York.
- Rolling Steel Shutters**
Jas. G. Wilson, 74 W. 23d St., New York.
- Roofing**
East. Gran. Roofing Co., Jersey City, N.J.
- Ropes**
Berlin Iron Bridge Co., K. Berlin, Conn.
King Bridge Co., Cleveland, O.
- Rolling Journal Bearings**
Menevel Bearing Co., W. Troy, N.Y.
- Rolling Stock to Lease**
Oliver Adams, 32 Liberty St., N.Y.
- Rubber Belting**
N. Y. Belt & Pack. Co., Ltd., 15 Park Row.
Peckless Rubber Co., 15 Warren St.
- Safety Valves**
Ashten Valve Co., Boston, Mass.
- Saw Mills**
Richmond (Va.) Loco. & Mach. Wks.
- Schools, Technical**
Rensselaer Polytechnic Inst., Troy, N.Y.
- Second-Hand Rolling Stock**
A. S. Males & Co., Cincinnati.
- Springs**
J. J. R. Croes, 13 William St., N.Y.
- Sewer Pipe**
Bacmer & Post, St. Louis, Mo.
R. D. Wood & Co., Philadelphia, Pa.
- Shafting**
Wm. Sellers & Co., Phila.
- Signals**
Hall Signal Co., 30 Broadway, N.Y.
Johnson R. R. Signal Co., Rahway, N.J.
Kelsey R. R. Signal Co., Florence, Mass.
Kinsman R. R. System Co., 143 Liberty St.
Moxier Safety Signal Co., Gallon, O.
Nat. Switch & Sig. Co., So. Bethlehem, Pa.
Union Switch & Signal Co., Pittsburgh
- Shylights**
Valle & Young, 229 No. St., Baltimore, Md.
- Snow Shovels and Plows**
Jail Mfg. Co., Brooklyn.
- Solid Staybolt Iron**
Falls Hollow Staybolt Co., Cuyahoga Falls, O.
- Spikes**
Dilworth, Porter & Co., Pittsburgh, Pa.
Q. & C. Co., Chicago.
Morris Sellers & Co., Chicago.
- Straps**
Farist Steel Co., Bridgeport, Conn.
A. French Spring Co., Pittsburgh, Pa.
Pickering Spring Co., Philadelphia.
- Steel Castings**
Chester Steel Castings Co., Philad'a., Pa.
Eureka Cast Steel Co., Latrobe, Pa.
Norristown Steel Co., Norristown, Pa.
Sharon Steel Castings Co., Sharon, Pa.
Solid Steel Co., Alliance, O.
Pratt & Leitchworth, Buffalo, N.Y.
- Steel Centre Plates**
Schoen Mfg. Co., Pittsburgh, Pa.
- Steel and Iron Plates**
Lakens Iron & Steel Co., Coatesville, Pa.
Wellman Iron & Steel Co., Thurlow, Pa.
- Steel and Steel Tires**
Latrobe Steel Works, Latrobe, Pa.
Midvale Steel Co., Norristown, Pa.
Thos. Prosser & Son, 15 Gold St., N.Y.
Standard Steel Works, Philadelphia, Pa.
- Switches and Switch Stands**
Allentown Rolling Mll., Allentown, Pa.
Elliott Frog & Switch Co., E. St. Louis, Ill.
Johnson R. R. Frog & Switch Co.
Kelsey R. R. Signal Co., Florence, Mass.
Nat. Switch & Sig. Co., So. Bethlehem, Pa.
Pennsylvania Steel Co., Steelton, Pa.
Ramapo Iron Works, Ramapo, N.Y.
Sheffield Veloc. Car Co., Three Rivers, Mich.
- Union Switch & Sig. Co., Pittsburgh, Pa.**
Weir Frog Co., Cincinnati, O.
- Tanks (Cedar)**
G. I. Burkhardt's Sons, Philadelphia, Pa.
- Tanks, Iron**
Fairbanks, Morse & Co., Chicago.
John N. Foage, Cincinnati, O.
- Taps and Dies**
D. Saunders' Sons, Yonkers, N.Y.
Manning, Maxwell & Moore, 111 Lib. N.Y.
- Testing Laboratory**
Pitts. Testing Laboratory, Pittsburgh, Pa.
Telegraph C-ail-Boil System
Electric Secret Service Co., N.Y. City
Gill-Alexander Electric Mfg. Co., Kansas City, Mo.
- Thermometers**
Standard Therm. Co., Peabody, Mass.
- Tie Plints and Braces**
W. R. Phillips, Box 288, Phila.
- Tie Plates**
Q. & C. Co., Chicago.
Shoulder Tie Plate Co., Philadelphia, Pa.
- Track Tools**
Fairbanks, Morse & Co., Chicago.
Metcalfe, Paul & Co., Pittsburgh, Pa.
- Transfer Tables**
Industrial Works, Bay City, Mich.
- Turn Buckles**
Cleveland City Forge & Iron Co., Cleveland, O.
- Turn Tables for Railways**
Coffrode & Saylor, Philadelphia, Pa.
Industrial Works, Bay City, Mich.
King Bridge Co., Cleveland, O.
A. S. Males & Co., Cincinnati.
- Passaic Rolling Mill Co., Paterson, N.J.**
Wm. Sellers & Co., Phila. and N.Y.
Valle, Bridge Co., Pittsburgh, Pa.
- Valves**
Ashten Valve Co., Boston.
Curtis Regulator Co., Boston, Mass.
Mason Regulator Co., Boston, Mass.
Rose Valve Co., Troy, N.Y.
R. D. Woods & Co., Philadelphia, Pa.
- Varnishes**
F. W. Devos & Co., Fulton street, N.Y.
Flood & Conklin, Newark, N.J.
Murphy & Co., Newark, N.J.
Edw. Smith & Co., Times Bldg., N.Y.
- Ventilators**
Car Ventilator Co., Phila.
Q. & C. Co., Chicago.
- Washers and Rivets**
Erry Ventilator Co., 115 B'way, N.Y.
- Water Columns**
Fuller Bros. & Co., 100 Greenwich St., N.Y.
- Waterproof Insul. Papers**
Standard Paint Co., 2 Liberty St., N.Y.
- Water Supply**
J. J. R. Croes, 13 William St., N.Y.
- Window Sash Cord**
Samson Cordage Works, Boston, Mass.
- Wire, Insulated**
Okonite Co. (Ltd.), N.Y.
- Wire Rope**
Trenton Iron Co., Trenton, N.J.
- Wood Working Machinery**
Berry & Orton Co., Philadelphia, Pa.
Egan Co., Cincinnati, O.
A. Fay & Co., Cincinnati, O.
Greenlee Bros. & Co., Chicago.
John A. White Co., Dover, N.H.
- Wrecking Cars**
Bucyrus Steam Shovel & Dredge Co.
Bucyrus, O.
- Wreaches**
Billings & Spencer Co., Hartford, Conn.
Rhode Island Tool Co., Providence, R.I.

MORAN FLEXIBLE STEAM JOINT CO.,

HENRY U. FRANKEL, President, 149 Third St. Louisville, Ky.

ALL-METAL REVERSIBLE PISTON COUPLING NO HOSE USED IN CONNECTION WITH FLEXIBLE BALL JOINTS FOR CONVEYING STEAM FROM COACH TO COACH. BLUE PRINTS ON APPLICATION.

THE AMERICAN WASHER & MANUFACTURING CO.,

13 & 15 RAILROAD PLACE, NEWARK, N. J.

EDWIN W. HINE, President.

L. L. STURGES, Secretary and Treasurer.

H. A. HARVEY, Vice-President.

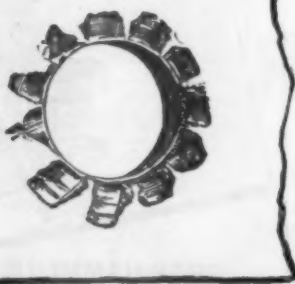
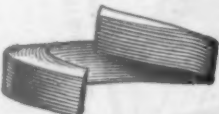
THE AMERICAN "HARVEY RIBBED" NUT LOCK.

A Resilient Spiral Spring Washer with Ratchet-Shaped Teeth.

Patented.

The American Harvey No. 1 Nut Lock, a resilient spring washer with chisel cutting edges. Patented. Tempered in oil.

SQUARE.



The American "No. 2 Square" Plain Spring, answers the purpose of all ordinary spring washers. Above pattern made of either round or square steel. Tempered in oil.

Our claim for this lock, aside from the unexcelled spring quality it possesses (being tempered in oil) is the tangential cutting or ratchet ribs on either side, and, reversed, so that when the nut is set down the ribs are embedded in both fish plate and under face of nut to such extent that a removal of the nut by force (and it can only be done with force) will show annular grooves plowed on surface of both nut and fish plate (see cuts above) without disturbing the thread of either nut or bolt, both of which, together with the nut lock, can be used again. This is a positive lock, with spring temper, and will not cut thread of nut or bolt.

CORRESPONDENCE AND ORDERS SOLICITED. SAMPLES FURNISHED FREE ON APPLICATION AND SENT TO ANY ADDRESS.

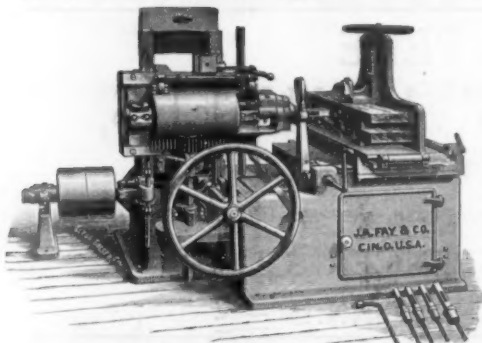
W. H. DOANE, Pres't.

D. L. LYON, Sec'y.

J. A. FAY & CO.,

CINCINNATI, O., U. S. A.

CAN FURNISH

Car, Locomotive and Railway Shops

No. 3 New Improved Hollow Chisel Car Mortiser.

—AWARDED—
 "Grand Prix," Universal Exposition, Paris, 1889.
 4 GOLD AND SILVER MEDALS AT
 Chicago Railway Exposition of 1883.

Complete Equipments

—OF—

**WOOD-
WORKING
MACHINERY.**

Catalogues and
 Estimates Furnished
 upon Application.

**ACME MACHINERY CO.,**

CLEVELAND, OHIO,

Manufacturers of

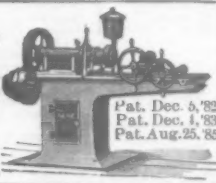
ACME BOLT & RIVET HEADERS

Acme Single & Double Automatic Bolt Cutters

Cutting from 1/4 in. to 6 in. diam.

Also, SEPARATE HEADS and DIES.

First Premium Cincinnati Centennial.



Pat. Dec. 5, '92
 Pat. Dec. 1, '93
 Pat. Aug. 25, '95

**MORSE
TWIST DRILL & MACHINE CO**

MANUFACTURERS OF

Patent Machine Relieved Nut and Hand Taps,

Suitable for use in Railroad, Car and Locomotive shops. We keep in stock a full line of U. S. or Franklin-Institute Standard Taps; also, V and Whitworth Threads also Pipe Taps, Pipe Reamers and Pipes Stocks, Dies, and Bushing

This cut shows the shape of the U. S. Franklin Institute Standard sometimes called the Sellers' Screw Thread.

MANNING, MAXWELL & MOORE,

SOLE SELLING AGENTS,

111 LIBERTY STREET
NEW YORK.**Morse Twist Drill & Mch. Co.**

Established 1864. New Bedford, Mass.

Manufacturers of Drills

Beach

Chucks,

Cutters,

Drill

Grinding

Machines,

and Special Tools.

CATALOGUES MAILED ON REQUEST

**BERRY & ORTON CO.,
ATLANTIC WORKS,**

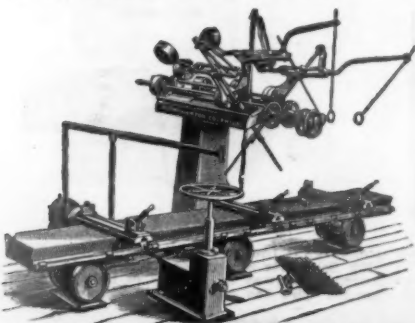
Twenty-Second above Arch St.,

PHILADELPHIA, PA.

Designers and Manufacturers of

**Machinery
for Working
Wood.**

Car Builders' Tools a Specialty.



Three-Spindle Universal Vertical Boring Machine.

Drawings and Estimates furnished upon application.

BEMENT, MILES & CO.

PHILADELPHIA, PA.,

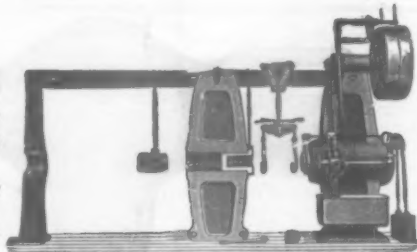
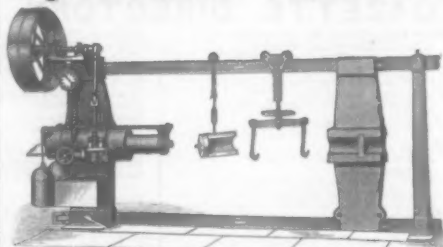
—BUILDERS OF—

METAL-WORKING**MACHINE TOOLS**

For Railroad Shops, Locomotive and Car Builders, Machine Shops, Steam Forges, Ship Yards, Boiler Shops, Bridge Works, etc.

Steam Hammers for Working Iron or Steel.

NEW YORK OFFICE, EQUITABLE BUILDING, GEORGE PLACE, AGENT.

**Hydraulic Tools for Railroads****IMPROVED CAR WHEEL PRESSES,**

Both Hand and Belt Power.

Hydraulic Jacks.

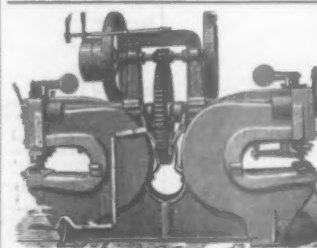
From 4 to 150 Tons Capacity.

Hydraulic Crank-Pin Presses

For forcing out Crank-Pins.

HYDRAULIC VALVES, GAUGES, FITTINGS, Etc.**Piston-Rod Extractors,** for starting Piston Rods from Cross-heads

LET US KNOW YOUR REQUIREMENTS.

WATSON & STILLMAN, Mfrs., 204, 206, 208 & 210 E. 43d St., N. Y.**The Long & Allstatter Co.,**

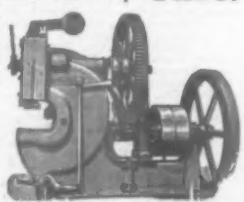
HAMILTON, OHIO.

Double, Single,
 Angle-Bar, Gang,
 Horizontal, Twin,
 Boiler, Spacing,
 Gate, Multiple,
 Belt and Steam-
 Driven

**Punches
& Shears.**

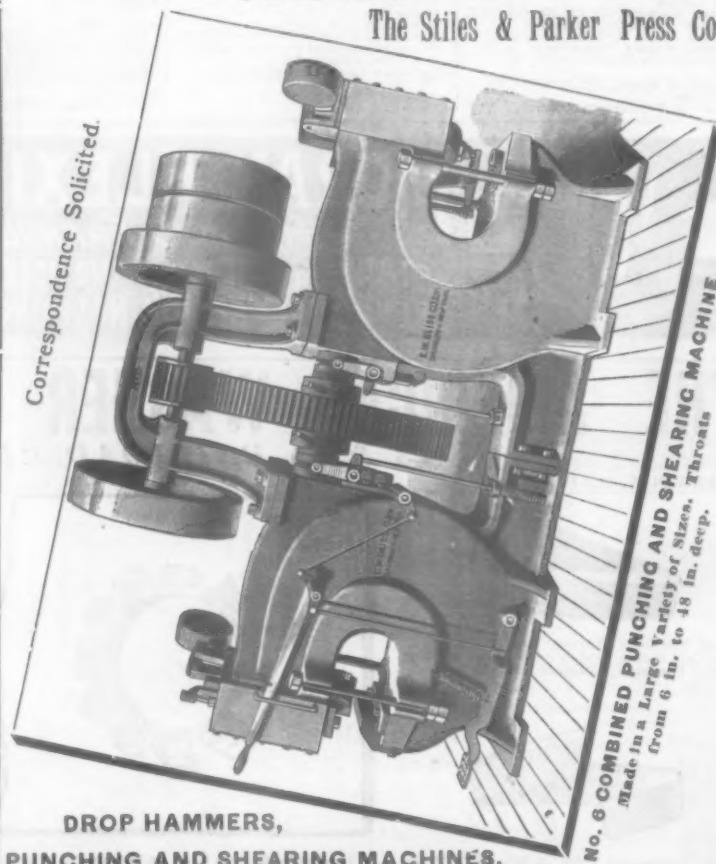
Over 300 Sizes.

Send for New Catalogue.

**E. W. BLISS CO., LTD.,**

No. 6 ADAMS ST., BROOKLYN, N. Y.

OWNERS ALSO OF

The Stiles & Parker Press Co.

**DROP HAMMERS,
PUNCHING AND SHEARING MACHINES.**

**Dies and Special Machinery for Lamps, Car Trimmings, Tanks,
Railroad Ties, Fish Plates, Etc.**

No. 6 COMBINED PUNCHING AND SHEARING MACHINE.
 Made in a Large Variety of Sizes, Throughs
 from 6 in. to 48 in. deep.

Correspondence Solicited.

DUPLEX BORING MACHINE.



This machine will bore two pump cylinders at one time, and while the centres are fixed, they can be built different distances apart to suit requirements. It is very strong, and has ample power for heavy cuts. Weight, about 4,500 pounds.

PEDRICK & AYER,

1001 & 1003 HAMILTON STREET, PHILADELPHIA, PA.



NO. 2 1/2 EXTRA LARGE
UNIVERSAL WOOD-WORKER.

Main Head 18 1/2 in. wide. Vertical Spindle and Head. For Railway work, etc. Will make glue joints; plane out of wind; chamfer; cross grain; groove; cut straight, circular or wave moldings; tongue and groove, plain taper; rip and cross-cut sawing; boring, routing, etc.

WOOD
WORKING
MACHINERY

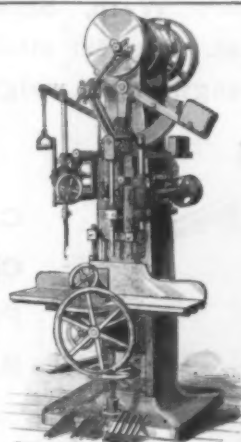
OF EVERY
DESCRIPTION.

WHY NOT GET THAT WHICH WILL
SERVE YOUR PURPOSES BEST?



THE LARGEST LINE IN THE U. S.
TO SELECT FROM.

OF THE
Highest
Grade
FOR
Fast, Perfect
AND
Economical
Work.



NO. 6 CAR MORTISER
AND BORER.

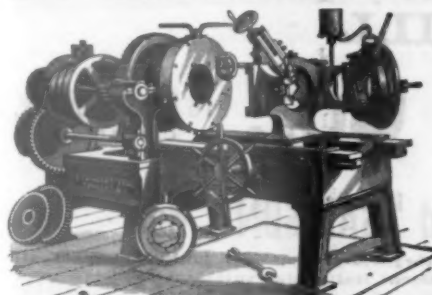
The most perfect ever devised for heavy work.

Cuts any size mortise from 1/4 in. to 3 in. wide and 6 in. deep in all kinds of wood.

This Car Mortiser has the graduating stroke and a patent chisel reverser which is entirely new and perfectly automatic. All other Car Mortisers are reversed by hand.

All machines of our construction are of the most advanced type and standard in every particular. Especially devised for the saving of time and labor.

D. SAUNDERS' SONS



SEND FOR CIRCULARS.

MANUFACTURERS OF
Pipe Cutting and
Threading Machines
For Pipe Mill and Steam
Fitters' Use.

Tapping Machines

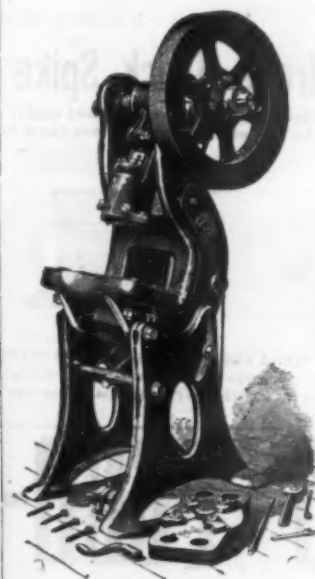
For Steam Fitting. Also,
STEAM AND GAS FITTERS
HAND TOOLS.

31 Atherton Street.
Send for Catalogue B.
YONKERS, N. Y.

GATES ROCK AND ORE BREAKER.

See Large Advertisement in Last or Next Issue of This Paper.
GATES IRON WORKS, 50a So. Clinton St., Chicago, Ill., U. S. A.

Large Special "PUNCHES" and "SHEARERS"
for Bridge and Girder Work, Iron
Buildings, etc., etc.



Foot Screw and Drop. Also Cutting,
Punching, Forming, Shearing,
Embossing, Coining
and Drawing

PRESSES

OF ALL SIZES AND KINDS.

DRAWING PRESSES and DIES

For Lanterns, Lamps, Tinware,
Brass Goods, etc.

FERRACUTE MACHINE CO.,

BRIDGETON, N. J., U. S. A.,

Manufacturers of all kinds of Presses, Dies and other Tools
for Sheet and Bar Metals.

Please Send for their Illustrated Price Lists, describing 150
kinds of Presses, Lathes, Rolls, Beaders, Trimmers, etc.

Greenlee Bros & Co
SPECIAL
WOOD WORKING
MACHINERY.
SEND FOR DESCRIPTION OF OUR NEW
AUTOMATIC CAR MORTISERS AND FOUR SPINDLE
CAR GAINER BORING MACHINE.
DOUBLE CUT-OFF MACHINE
CHICAGO.

PHILADELPHIA CORLISS ENGINES
PHILADELPHIA ENGINEERING WORKS LTD.
NON CONDENSING
CONDENSING
TRIPLE EXPANSION
SUPERIOR WORKMANSHIP
& FINISH
DESIGN WORKMANSHIP
& FINISH
CATALOGUES MAILED
ON APPLICATION.
W. W. LINDSAY, MANAGER WESTERN BRANCH, PHOENIX BUILDING, CHICAGO, ILL.

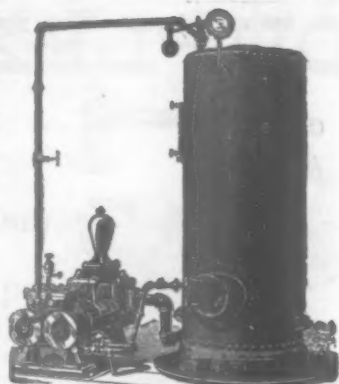


SECTION CARS with Pressed Steel Wheels, made from single-piece tough plate, free from joints, angles and bolts. Don't Warp, Shrink nor Collapse. Highest attainment in strength, light weight, durability.

FAIRBANKS, MORSE & CO.,
CHICAGO.

WATER TANKS, Fixtures, Automatic Stand-Pipes, Steam Pumps, Boilers, Valves, Pipe and everything appertaining to Water Supply for Railroad Stations, Roundhouses and Stock Yards.

Plants completely installed or materials and plans furnished.



BARRETT JACKS in variety of patterns for Track, Bridge, Oil Box, Car Raising, Wrecking and other service. Formally adopted as Standard by the Roadmasters' Association of America, in late session at Minneapolis. Other Jacks have merit; none but the Barrett combines desirable features.



WRECKING FROGS, Track Tools, Scrapers, Dump Cars, Carts and other earth-moving implements; Push Cars, Raillayers' Cars; Single, Duplex and Compound Pumps, Windmills and Force Pumps, Engines and Boilers.

Request Catalogue of Above and Kindred Supplies for Railroad Purposes.



CHICAGO SPLICE BAR MILL.

New England Agents,
SHERBURNE & CO.,
No. 53 Oliver St., Boston.

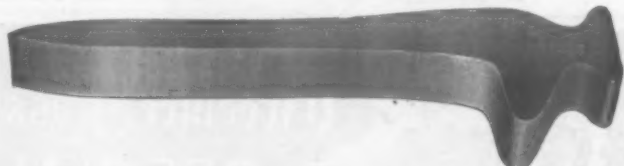
Morris Sellers & Co.,

MANUFACTURERS OF THE

OFFICE,
216 Phenix Building,
CHICAGO.

New "GREER" Railroad Track Spike and the Celebrated "SAMSON" Bar.

Fourteen years' unexampled success has demonstrated the fact that under all varieties of Railroad Service they will prevent "low joints," battered rail ends, and in a remarkable degree withstand the test of breakage. More than 10,000,000 Bars in use on 100 different Railroads, equivalent to 14,240 miles of track.



The "Greer" Railroad Track Spike is the latest and best spike offered to the Railroad managements of this country and Great Britain. Indestructible. A holding power of from one to two tons more per spike than any $5\frac{1}{4} \times 9-16$ spike. Automatically sharpened to chisel edge, it cuts; does not tear the wood fiber. Hand packed in kegs—every spike perfect. Particularly adapted for use on Bridges, Trestles, Frogs, Crossings and Switches. SEND FOR TESTS AND PHOTOGRAPHS.

THE FIELD FEED-WATER PURIFIER

This device will not successfully handle **all waters**, but there are **none** that it will not improve. In a **large majority** it will demonstrate great economy.

The apparatus can be made at railroad shops at small expense.

A trial is solicited at our expense.



Cut showing Purifier Applied to Locomotive.

This water purifier is now in use and on trial on the following railroads:

Wisconsin Central.
Great Northern.
Northern Pacific.
Atchison, Topeka & Santa Fe.
Baltimore & Ohio.

We refer to each of them.

Office: 134 Van Buren Street.

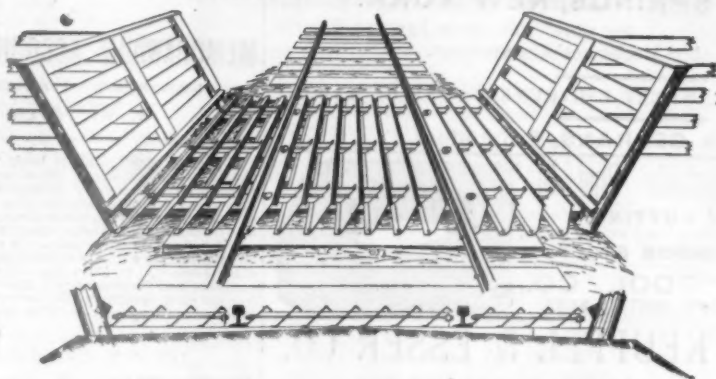
CHICAGO, ILL.

Factory: 43d St. & Stewart Ave.

THE "STANDARD" CATTLE GUARD

LEADS ALL GUARDS IN EFFECTIVENESS
AS A RESULT OF RECENT TESTS.

Strong, Effective, Cheap.
Light, Easily Adjusted, Safe.



WRITE FOR PRICES.

Weights Less than 400 lbs.

THIS GUARD WORKS ON AN ENTIRELY NEW PRINCIPLE.

Is Manufactured of Steel Under Original Patents.
Guards Against HOGS and SHEEP as Well as Large Stock.

THIS GUARD HAS BEEN PURCHASED BY:

The Pennsylvania,
Chicago & Grand Trunk,
Ohio & Mississippi,
Chicago, Burlington & Quincy,
B. & O. Southwestern,
East Tennessee, Virginia & Georgia

And Others, Although It Has Only Been on the Market TWO MONTHS.

39-43 WEST WASHINGTON STREET,

CHICAGO, ILL.

STEEL SURFACE CATTLE GUARDS

—MANUFACTURED BY—



For Testimonials, Prices, Etc., Address

BUSH CATTLE GUARD CO., Kalamazoo, Mich.

HOISTING ENGINES.



Of any Power and Style, SINGLE AND DOUBLE CYLINDER, with improved patent friction drums especially adapted for all classes of work. Single and Double Drum, friction and direct geared, Link motion MINING Engines. Four, six and eight spool, lock clutch, self propelling BRIDGE ERECTING Engines. Double cylinder, double friction drum DOCK BUILDING and PILE DRIVING

Engines. Quick motion, friction geared COAL HOISTING Engines. Powerful compound geared and friction geared QUARRY Engines. WITH OR WITHOUT BOILERS. Any amount of reference given. Established 1870.

J. S. MUNDY, 20-34 Prospect St. Newark N. J.

LINK BELT MACHINERY CO.

CHICAGO, ILL.,

MANUFACTURERS OF IMPROVED

FREIGHT AND COAL
HANDLING MACHINERY.

Kalamazoo Railroad Velocipede & Car Co.,

KALAMAZOO, MICH., U. S. A.,

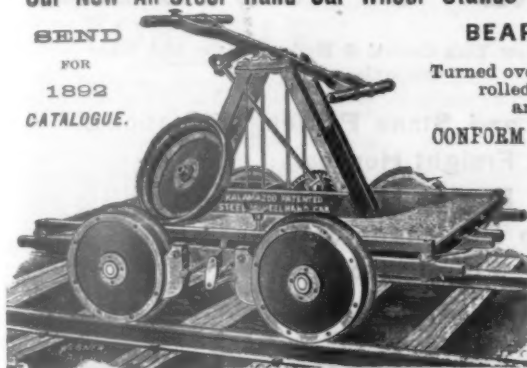
MANUFACTURERS OF

Different Styles of Steel Velocipedes,
Steel-Wheeled Hand Cars,
Rail or Construction Cars,
Hand and Steam Inspection Cars.

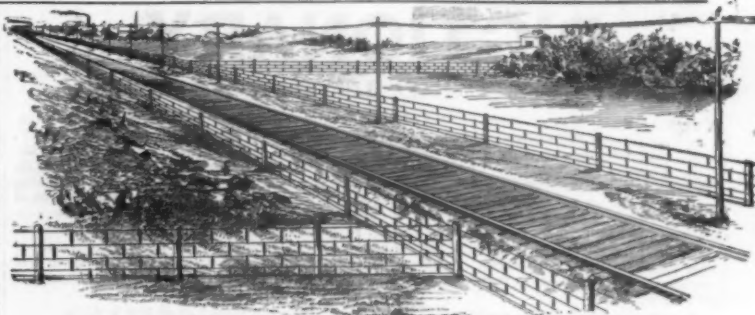
Iron and Steel Wheeled Push Cars,
Pit or Mining Cars,
Sugar-Cane Cars,
Steel Surface Cattle Guards.

Our New All-Steel Hand Car Wheel Stands 20½ Tons Pressure
BEARING ON HUB.

SEND
FOR
1892
CATALOGUE.



Turned over Flange. Steel Tires,
rolled perfectly smooth
and cylindrical,
CONFORM TO M. C. B. STANDARD.



We use the "Duncan" Steel Stay-Guard and the "Australian" Stretcher-Fastener.

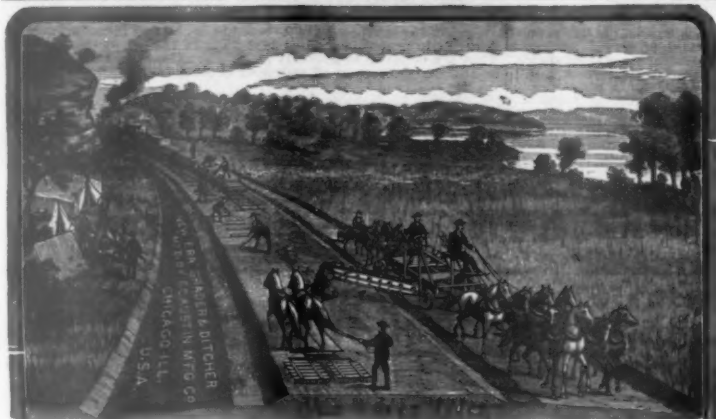
Barkley & House, Contractors and Builders of all kinds of RAILWAY FENCES, TELE-
GRAPH AND TELEPHONE LINES.
1159 The Rookery, CHICAGO.

GRAPHITE PAINT.

For Tin or Shingle Roofs and Iron Work.

It is Absolutely Without an Equal. A tin roof well painted will not need repainting for 10 to 15 years. If you need any paint it will pay you to send for circular.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.



New Era Grader, Ditcher and Railroad Builder.

In building railroads makes cuts or fills embankments for 2 cents per cubic yard, moving 1,000 to 1,500 cubic yards in 10 hours with six teams and three men. Loads 600 to 800 wagons of 1½ yds. in same time at a cost of 2½ cents each. Builds country roads at the rate of one mile in three days. We also make the Austin-Reversible Road Machine, Buck Scraper, Wheel and Drag Scrapers, Compactors' Plows, and Street Sweepers. Send for catalogue.

F. C. AUSTIN MFG. CO., Chicago, Ill.



HIGH ECONOMY. NOISELESS OPERATION. CLOSE REGULATION.

TAKE THE STONINGTON LINE.

ALL FARES REDUCED.

The Inside Route Between New York and Boston,
Providence, Worcester and all Eastern Points.

Steamers "Maine" and "New Hampshire" leave New York from new Pier 38, N. R., one block above Canal St., at 5.30 P. M., daily, except Sunday, connecting with 3 Express Trains for Boston. Steamboat Express with Reclining Chair Cars Free of Charge.

J. W. MILLER, President.

O. H. BRIGGS, C. P. A.



ESTABLISHED 1830.
PATENT TRANSITS
YOUNG & SONS,
Engineering Instrument Makers,
43 NORTH SEVENTH STREET,
Philadelphia.
Tapes, Chains, Draughting In-
struments. Catalogues on appli-
cation.

New Revised Edition of
CAR-BUILDERS' DICTIONARY,
Price, \$3 a copy.

DRAWING AND ENGRAVING

The Railroad Gazette, finding it necessary to increase its facilities for executing its own engravings, is now prepared to fill orders for **ACCURATE**

ARTISTIC
DRAWINGS AND
ENGRAVINGS
of all kinds, working either from objects, photographs, blue-prints or sketches.

ADDRESS
THE RAILROAD GAZETTE
73 BROADWAY, NEW YORK.

SUNDAY SERVICE.

On Sunday, May 22d, the Wisconsin Central Lines will resume its popular train service between Chicago, Waukesha and the Lake Region. Trains will leave the Grand Central Passenger Station, for Lake Villa (Fox Lake), Antioch, Mukwonago and Waukesha at 8:30 A. M., Sunday, arriving at Lake Villa 10:33 A. M., Antioch 10:40 A. M., Mukwonago 11:40 A. M., and Waukesha 11:49 A. M. Returning leave Waukesha 4:45 P. M., Mukwonago 5:05 P. M., Antioch 6:18 P. M., Lake Villa 6:30 P. M., arriving at Chicago 8:45 P. M. For the accommodation of excursionists desiring to remain in the country over Sunday "The Business Man's Special" will again be placed in service. This train will leave Waukesha at 5:30 A. M., arriving at Chicago at 8:50 A. M. For tickets, time tables and pamphlets apply to GEO. K. THOMPSON, City Passenger & Ticket Agent, Chicago, Ill. Or to JAS. C. FOND, General Passenger & Ticket Agent, Chicago, Ill.

THE

RAILROAD GAZETTE

has more Railroad Officers as subscribers and readers than all other railroad papers combined. Its advertising rates are no higher than those of papers having less than half its circulation.

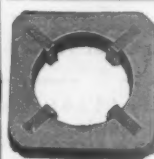
Grand Union Hotel,

SARATOGA SPRINGS, NEW YORK.

The finest Summer Hotel in the world will open June 14 for the Master Car Builders' and Master Mechanics' Conventions.

OFFICE, 115 BROADWAY, WHERE ENGAGEMENTS CAN BE MADE.

WOOLLEY & GERRANS, Proprietors.



Hayes Adjustable Pipe Die.
EASY CUTTING,
CAN BE SHARPENED, CAN BE ADJUSTED.
FITS COMMON STOCK.
HAYES TOOL CO.,
41 and 43 CROSS ST., PORTLAND, MAINE.



KEUFFEL & ESSER CO.

LATEST AND MOST IMPROVED

TRANSITS, all kinds,
LEVELS, and other
FIELD INSTRUMENTS

—FOR—

ENGINEERS AND SURVEYORS.

Office Drawing Materials in large variety.

CATALOGUE ON APPLICATION.

265 State St., CHICAGO. 127 Fulton St., NEW YORK.

We are making a Specialty
of the Preparation, Design and Printing of
Fine Trade Catalogues.

Samples and Estimates upon Application.

H. B. Prindle & Co.

522 Exchange Building, Boston, Mass

ENGINEER'S AND FIREMAN'S

TIME, EXPENSE

AND

MEMORANDUM ACCOUNT BOOK.

DESIGNED AND COPYRIGHTED BY

E. W. YATES.

A pocket memorandum book with rubber tipped pencil attached, with calendar and pages most conveniently arranged for the engineer or fireman to keep his own daily record of time and miles run, rate and amount earned; also for individual expense account each month and for general memoranda. A certain method of checking with the timekeeper in case of disagreement. It lasts one year, and every engineer and fireman should have one. Price 0 cents each; \$20.00 for fifty copies, or \$35.00 a hundred. An agent wanted on each road.

PUBLISHED AND FOR SALE BY

THE RAILROAD GAZETTE, 73 Broadway, N. Y.

TABLES OF AREAS

Right-Angled Triangles

(Slopes of 1/4:1 to 4:1)

By JNO. MCGEE, C. E.

Prepared to facilitate calculations of end areas of prismsoids of earthwork where the lateral slope is irregular. Economizes labor and insures accuracy.

FLEXIBLE COVER. PRICE, 25 CENTS.

THE RAILROAD GAZETTE

73 Broadway, New York.

THE ROAD-MASTER'S ASSISTANT

AND

SECTION-MASTER'S GUIDE

REVISED EDITION.

A Manual of Reference for all having to do with the permanent way of American Railroads containing the best results of experience, and minute directions for track-laying, ballasting and keeping the track in good repair. By Wm. S. Huntington. Revised and enlarged by Charles Latimer, Chief Engineer of the Atlantic & Great Western Railroad.

Three hundred pages, size 4 1/4 by 7 inches. Fifty illustrations. Pocket edition on thin paper, bound in leatherette with red edges; or muslin binding, thick paper. Price \$1.50.

Published and for sale by

THE RAILROAD GAZETTE,

73 Broadway, New York.

DICTIONARY

OF TERMS USED IN CAR-BUILDING

THE RAILROAD GAZETTE has published one of the most valuable and elegant technical books ever made—the revised and greatly enlarged edition of the Car-Builders' Dictionary. The original edition was compiled in 1880 for the Master Car-Builders' Association by Mr. M. N. Forney and others. The present edition, compiled by the Railroad Gazette staff, assisted by members of the Association, has been doubled in size, and contains nearly three times as many engravings. Its 2,188 engravings include exact drawings of American Cars of every description, and of the different kinds of Trucks, Wheels, Brakes, Couplings, Seats, Lamps, Heaters, and all Car furnishings in general use, in the minutest detail. All the detail drawings are made to scale, and each engraving is briefly described under the definition of its name. All terms in general use in car-building are defined, and a vocabulary of the leading terms used in English Railway Carriage and Wagon construction is added.

We know of no book of equal appearance and value ever issued at so low a price.

One book will be given free for each cash order for 5 books. Price \$3.00 per copy.

For Sale by THE RAILROAD GAZETTE, 73 Broadway, New York.

3 BOOKS THAT SHOULD BE IN THE HANDS OF EVERY RAILROAD MAN:

Catechism of the Locomotive, by Forney.

Train Wire, by Anderson.

Block Signaling, by Adams.

—ADDRESS—

RAILROAD GAZETTE, 73 Broadway, New York.

NEW, REVISED, ENLARGED EDITION

—OF—

THE TRAIN WIRE.

A Discussion of the Science of Train Dispatching, by J. A. ANDERSON, of the Pennsylvania Railroad, with an Introduction by B. B. ADAMS, Jr., of the Railroad Gazette.

152 Pages (5 x 7 1/2 in.). Price \$1.25.

The first eight chapters are discussions of the general principles, and treat of: Train Dispatching, the Dispatcher, the Operator, the Order (with photographic illustrations of very good and very bad manuscripts), the Manifest, the Record, the Train-Order Signal, the Transmission. Chapter Nine contains the standard code of rules for the movement of trains by telegraphic orders, with comments on each rule, giving valuable practical advice as to its application in special cases, and making its purpose and necessity clear. Chapter Ten contains the standard forms of train orders, and the remaining chapters treat of rules as to rights of track, numbering switches, &c. The book is complete and exhaustive as a practical handbook and course of instruction for an inexperienced operator, and there are few superintendents or dispatchers who may not learn much from Mr. Anderson's long experience in this department. He is probably the best authority in the world on train dispatching.

Published and for Sale by THE RAILROAD GAZETTE 73 Broadway N. Y.

Standard Specifications

FOR

RAILROAD STRUCTURES,

As used by the New York Central & Hudson River and other companies.

- No. 1. Brick and Stone Passenger Stations.
- No. 2. Brick Freight Houses.
- No. 3. Brick Engine Houses.
- No. 4. Frame Passenger Stations.
- No. 5. Frame Freight Houses.

COPYRIGHTED BY C. F. BOND.

"These Specifications are intended to embrace the entire structure, complete and ready for occupancy, the whole of the work to be comprised within these specifications for any contract or partial contracts that may be made for the construction of the same."

They are the result of long years of study and experience in construction work on different railroads. It has been the aim of the author to put nothing in the specifications which needs to be erased, leaving blank lines in proper places for insertion of such conditions as are needed for special localities. They are believed to properly guard both the company's and the contractor's interests, and to be adapted for use on all railroads in America.

PRICE, 50 CENTS EACH.

PUBLISHED AND FOR SALE BY

The Railroad Gazette, 73 Broadway, N. Y.

"HANDLING RAILWAY SUPPLIES."

An exhaustive treatise on the purchase, receipt, inspection, storage, disbursement and use of railway material. Also a pamphlet on the

"REQUISITIONS OF RAILWAYS,"

Embracing rules and regulations intended to prevent excessive purchases or the accumulation of undue stores either at a shop or upon a line as a whole. These books do not treat of accounts, but of the principles that must be observed by a company in order to prevent improper practice, extravagance and waste in its material accounts.

The book and pamphlet..... \$2.50

By MARSHALL M. KIRKMAN.

Published and for Sale by THE RAILROAD GAZETTE, 73 Broadway, N. Y.



Published Every Friday at
73 Broadway, N. Y.
\$4.50 PER YEAR TO UNITED STATES AND CANADA.
\$5.00 " " FOREIGN COUNTRIES.
Express money orders, or drafts, or P.O. orders
or registered letters should be made to the order
of the RAILROAD GAZETTE.

EMPLOYMENT.

WANTED—A DRAFTSMAN familiar with car works. Address "DRAFTSMAN," care Railroad Gazette.

WANTED—SEVERAL MORE experienced mechanical draftsmen. Also Bridge and Architectural Draftsmen. **ENGINEERING EMPLOYMENT BUREAU,** 8 Granger Bldg., Syracuse, N. Y.

WANTED—A MECHANICAL draftsman with technical education and shop experience, for principal in motive power drafting room of a Western railroad. Address, stating age, education, experience, references and salary expected, "Chicago," care Railroad Gazette.

WANTED AND FOR SALE.

FOR SALE.
We own and offer for sale 100 tons of selected second-hand 52-lb. steel rails for prompt shipment. Rails can be inspected at Pittsburgh. Price quoted on application to
ROBINSON & ORR,
419 Wood St., Pittsburgh, Pa.

WANTED.

A First-Class Railroad Contractor with Outfit to Lay 80 Miles of Track.

None but experienced men need apply. Address **CONTRACTOR,** care Railroad Gazette.

FOR SALE—ONE LIDGERWOOD double 24 x 10 double drum; one Lidgerwood double 7 x 10 double drum; one Lidgerwood double 6 1/2 x 8 single drum; one Mundy double 6 1/2 x 12 double drum; one Mundy double 7 x 12 single drum; three pile drivers and hammers, three steam dredges, three steam shovels, 3 ft. locomotive cars, rails, contractor's tools, Carson trench digger, derricks, scows, two and four million gallon pumps, boilers, rollers, tanks, all sizes; road scrapers, 4 and 10-in. pipe, compressors, crushers; engines, all sizes. W. S. MIDDLETON, 52 John street, New York.

FOR SALE.

For immediate delivery, a number of
Standard Gauge Locomotives,
Now in use on the Northern Pacific Railroad.
Cylinders 15 x 22 inches, 15 x 24 inches.
Weight, 59,000 to 72,000 pounds.
Two Narrow Gauge, 6-wheel
Locomotives,
Cylinders, 12 x 18 and 12 x 24 inches.
Weight, 48,000 to 74,000 pounds.
FULL DESCRIPTION ON APPLICATION.

CEO. A. EVANS, 18 Wall St., New York

WANTED—800 TONS 35-LB. T Steel Rails and Fastenings. Payment in 5 per cent. 30-year gold bonds of completed road, or on six-month bonds as collateral. Box 300, De Witt, Ark.

FOR SALE.

One combination passenger and baggage car and two passenger coaches—standard gauge; equipped with Westinghouse brakes; nearly new; immediate delivery.
Two open excursion cars, seating 35, for sale at a bargain.

HUMPHREYS & SAYCE,
10 WALL ST., NEW YORK.

BOILER MAKERS' TOOLS

FOR SALE.

One 95-in. Hydraulic Riveting Machine, with wrought iron stake, 70 tons pressure on the rivet, with pressure Pump and Accumulator.
One 10-ton Traveling Crane, Bridge 24 ft. between centre of rails by 20 ft., all movements by power, two speeds, 3 and 8 ft. per minute, controlled by four levers placed alongside riveting Machine.
One Power Punching Machine, will punch 14 in. in 1 in. iron, 30 in. from edge of plate.
One Power Shearing Machine from same patterns, with same strength as the Punch.
One Plate Planing Machine, to plane 16 ft. long, without shifting, provided with special table to receive firebox fronts, overhanging housings, clamping bar raised and lowered by connected screw, vertical, horizontal and angular feeds, planes 3/4 in. steel plate.
One Set Bending Rolls, 8 ft. between housings, two lower rolls 10 in. diameter, upper roll 11 in. diameter, so constructed that circular form can be withdrawn without removing the top roll.
The above were built by Bement, Miles & Co., Philadelphia, Pa. Are entirely new, will be sold separately or together. Immediate delivery.

GEORGE PLACE MACHINE CO.,
120 Broadway, New York.

\$40,000,000

Earned by the Bell Telephone Patent in 1891. Your invention may be valuable. You should protect it by patent. Address for full and intelligent advice, free of charge.

W. W. DUDLEY & CO.,
Solicitors of Patents,
Pacific Bldg., 622 F St. N. W.,
Washington, D. C.

INSPECTION

Engineering Employment Bureau,
8 GRANGER BLOCK, SYRACUSE, N. Y.

Furnishes Employers with Engineers, Superintendents, Chemists and Draftsmen.

Large number of reliable men constantly on file. Prompt—Honest—Experienced.
No Charge to Employers.

SECOND HAND STEEL RAILS.

1,000 tons 60-lb. section, fit for relaying. Also Old Rails for Builders' and Contractors' use, in quantities to suit. For sale by

WM. H. PERRY & CO.,
PROVIDENCE, R. I.

TEE AND STREET RAILS, SPICE BARS, TRACK BOLTS AND NUTS, R. R. SPIKES.

FLOORS, CROSSINGS, SWITCHES AND FIXTURES.

IRON AND STEEL AXLES, CAR TRUCK CHAINBELLS, WROUGHT IRON TUBES, BUCKLES, LINKS AND PIN AND CAR COUPLERS.

BAR IRON AND STEEL, SHEET IRON AND STEEL, CORRUGATED IRON.

STEAM SHOVELS, BALLAST UNLOADERS, AND STEAM CRANES.

A. T. SHOEMAKER,
Railroad Supplies
and Equipment.

(New and Second Hand.)
146 BROADWAY,
NEW YORK.

BEAMS, CHAINBELLS, ANGLES
TEES AND ODD SECTIONS.

VAILE & YOUNG'S
Patent Metallic Skylights.



Without Putty.
Construction adapted to all forms and styles of Skylights. Thousands of feet in use have proved its superiority. Particularly adapted for Depots, Mills, Factories, etc., where large and continuous lights are required. Send for Illustrated Catalogue.

HALF SIZE.
216 N. Calvert St., Baltimore, Md.

FOR SALE.

Also Saddle Tank Engines, Cylinders, 10 x 14 inches. Weight, 26,000 pounds.
Several Forney Type Engines, Cylinders, 10 x 14 inches. Weight, 33,000 to 36,000 pounds.
For New York Delivery.
Steel Rails, Fastenings and All Classes of New and Second-hand Equipment.

VON SOHON & GARNER, Civil Engineers
FREDERICKSBURG, VA.

Examination of railroad projects and property; surveys and locations of railroads. We operate throughout the South. Estimates free.

J. A. L. WADDELL
Consulting Bridge Engineer,
KEITH AND PERRY BUILDING,
KANSAS CITY, MO.

Superstructure. Substructure.
Engineer in charge of Western Office of the Phoenix Bridge Co. Special attention paid to deep borings to and into bed rock.

THOMAS APPLETON,
M. A. R. C. E.,
Civil Engineer and Architect,
General Engineering and Architectural Work.

SPECIALTIES: Railway Terminals, Switching Yards, Passenger Stations, Freight Depots, Coal and Ore Docks, Round Houses, Machine Shops, Foundries, etc.

505 RIALTO BUILDING, CHICAGO, ILL.

Member Am. Soc. Civil Engineers.
Member Am. Inst. Mining Engineers.
Associate Am. Inst. Electrical Engineers.

FREDERICK H. SMITH,
Consulting Engineer & Geologist, Bridge Engineer
227 E. German St., Baltimore, Md.

GEO. L. FOWLER,
Mechanical Engineer,
53 Broadway, New York.

Special attention given to Designing, Testing and Constructing Railroad Machinery and Rolling Stock.

Sole Agent for Johnson's Portable Suits

J. JAMES R. CROES,
M. Am. Soc. C. E.; M. Inst. C. E.,
13 William Street, New York City,
CONSULTING ENGINEER.

Examinations and Reports made on Projects for Water Supply and Sewerage of Towns, Rapid Transit and River Improvements.

Plans and specifications prepared and Work of Construction superintended.

QUEEN & CO., PHILADELPHIA,

MANUFACTURERS OF

Engineers', Surveyors' and
Draughtsmen's Supplies.

Improved Complete Engineers' Transit.



Power of telescope, 24 diam. Compound long centers. Two outside verniers. Five-in. needle. Level to telescope, vertical arc, clamp and tangent and the usual accessories. Complete with box and tripod. **PRICE, \$180.**

ENGINEERS' PLAIN TRANSIT.

Same as above, without level, arc or clamp and tangent. **PRICE, \$150.**

Improved Engineers' Wye Level.

Telescope, 18 or 20 in. Power, 40 or 50 diameters, as desired. Shifting center. Complete with box and tripod and usual accessories. **PRICE, \$110.**

Any of these instruments sent on approval, with privilege to return if not satisfactory.

CATALOGUE ON APPLICATION.



L. BRECKINRIDGE CABELL,

—DEALER IN—

Lands, Securities and Industrial Enterprises.

Total Issues of Corporate, Municipal and County Bonds Taken.

RAILROADS BUILT AND EQUIPPED.

53 Broadway, Room 17, - - - NEW YORK.

Flood & Conklin Co.

VARNISH MAKERS,

NEWARK, N. J.



Railway Varnishes and
Surfacers

A SPECIALTY.

CHARLES S. HELLER

(ESTABLISHED 1870.)

TRADING AS



HELLER & BRIGHTLY,

MANUFACTURERS OF

ENGINEERING, MINING AND SURVEYING

INSTRUMENTS,

Cor. SPRING GARDEN STREET and RIDGE AVENUE,
PHILADELPHIA, PA.

CHARLES H. BRIGHTLY.

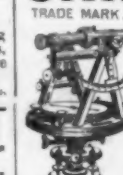
TRADE MARK.

Late of HELLER & BRIGHTLY,

MANUFACTURER OF

Mathematical, Engineering and Surveying

INSTRUMENTS.



Germantown Junction, P. R. R.

18th St. Station, P. & N. E. P.

PHILADELPHIA, PA.

D. L. BARNES,
Mechanical and Consulting
Engineer.

SPECIALTY: RAILWAY and LOCOMOTIVE WORK.

Marine and land engine tests made at short notice. Recent and scientific methods used in all work.

The completion of inventions to practical application, including specifications and estimates, forwarded by new methods.

73 BROADWAY, NEW YORK, and

Rookery Building, Chicago, Ill.

CONTRACTS WHERE TO FIND THEM.

See Engineering News, N. Y. City
Single Copies, 15 cents. All Newsdealers.

Charles Paine & Sons

Consulting and Civil Engineers,

71 Broadway, New York City.

**Rail
Roads**

Preliminary Surveys,
Location,
Construction,
Equipment,
Water Supply,
Terminal Yards
Signals,
Electric Appliances.

Improvement of Villages and Estates.

THE NATIONAL MALLEABLE CASTINGS CO.

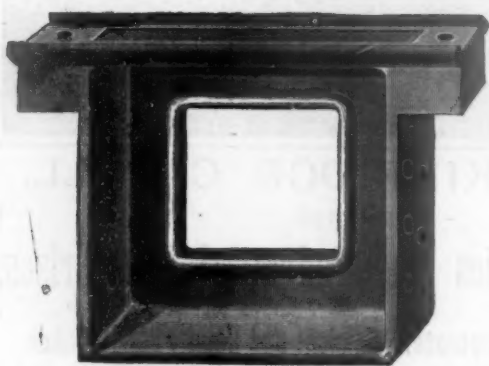
—OPERATING THE—

Cleveland Malleable Iron Works.
Indianapolis Malleable Iron Works.

Chicago Malleable Iron Works.
Toledo Malleable Iron Works.

—MANUFACTURERS OF—

REFINED MALLEABLE IRON CASTINGS.



Draw Bars, Center Plates, Side Bearings, Truck Ends, Chafing Plates, Swing Hanger Bearings and Pivots, Dead Blocks, Draw Bar Stops, Brake Hangers, Door Fasteners and many other articles used in Car Construction and Repairs.

Head Chairs, Step Chairs, Slide Switch Plates, Rail Braces, Switch Nibs, and other Castings used in Maintenance of Way. Shop, Engine and Track Wrenches. Other Castings made to order.

Our Largely Increased Facilities Justify Us in Soliciting Your Patronage

Address the NATIONAL MALLEABLE CASTINGS CO. at either of the four points named above.

GEO. A. BOYDEN, President.

WM. WHITRIDGE, Treasurer.

CHAS. B. MANN, Secretary.

THE BOYDEN BRAKE COMPANY, BALTIMORE, MD., U. S. A.

MANUFACTURERS OF

AUTOMATIC QUICK-ACTION AIR BRAKES

FOR PASSENGER CARS, FREIGHT CARS AND TENDERS.

ALSO DRIVER BRAKES AND AIR EQUIPMENT FOR ENGINES.

The Entire Brake and Signal Apparatus Is Interchangeable with the Westinghouse

OUR APPARATUS IS IN SUCCESSFUL OPERATION ON 45 ROADS.

IT PAYS FOR ITSELF.

Individual Continuous-Ringing Telegraph Call

—WITH—

AUTOMATIC ANSWER BACK.

MODEL OF 1892.

**ELECTRIC SECRET SERVICE COMPANY,
45 BROADWAY, NEW YORK.**

C. P. MACKIE, Gen. Man.

S. S. BOGART, Gen. Agent.

J. W. LATTIG, Gen. Supt.

**OF COURSE**

You desire to be certain that your
DAMPER

is always properly adjusted to the
requirements of the Steam pressure.

THERE IS BUT

ONE SURE WAY
TO DO IT.

PUT IN A + + + +

CURTIS Damper Regulator.

It is a MARVEL OF ACCURACY, and is especially adapted to VERY HIGH PRESSURES; e. g., where compound steam engines are used for generating electricity, etc. We GUARANTEE this DAMPER REGULATOR to operate on a variation well WITHIN ONE POUND in THE BOILER PRESSURE. MANY HUNDREDS have been put in operation during the past six years in the

LARGEST STEAM PLANTS from Maine to New Orleans, and have given the HIGHEST SATISFACTION. They will save you

STEAM, COAL AND MONEY.

They are controlled by steam direct from the boiler, and require neither street pressure nor extensive condensing surface to furnish water to operate them. Full particulars cheerfully furnished by the

CURTIS REGULATOR CO., 59 BEVERLEY STREET, BOSTON, MASS.

PAUL S. REEVES,

PHILADELPHIA.

PHOSPHOR BRONZE

IN INGOTS AND CASTINGS.

LEAD LINED CAR BEARINGS

A SPECIALTY.

Brass and Phos. Bronze Castings from 1 lb. to 5,000 lbs. in Weight.

The 1892 Model Remington

→ Typewriter ←



Presents many points of improvement which will readily commend themselves to all users.

SEND FOR CATALOGUE.

WYCKOFF, SEAMANS & BENEDICT, 327 Broadway, N. Y.

TABLES OF AREAS

—OF—

Right-Angled Triangles

(Slopes of $\frac{1}{4}$:1 to 4:1).

By JNO. MCGEE, C. E.

Prepared to facilitate calculations of end areas of prismoids of earthwork where the lateral slope is irregular. Economizes labor and insures accuracy.

FLEXIBLE COVER.

PRICE, 25 CENTS.

THE RAILROAD GAZETTE,

73 BROADWAY, NEW YORK.

American Practice in Block Signaling.

With Descriptions and Drawings of the Different Systems in Use on Railroad in the United States.

This is a handsomely printed, elegantly bound volume, 7 $\frac{1}{4}$ in. x 9 in. It describes clearly the Simple Block System, Single Track Blocking System, Automatic Clockwork Track Circuit Signals and the Electro-Pneumatic Track Circuit System. It contains elaborately illustrated descriptions of the systems in use on the Pennsylvania, Boston & Albany, Fitchburg and New York Central Roads, and correct engravings and descriptions of the Westinghouse Pneumatic, the Hall Automatic and Black's Automatic Systems; and also of the Illuminated Semaphore, Koyl's Parabolic Semaphore and the Stewart Hall Train Order Signal.

The book is designed to make the methods of block signaling clearly understood and to show the present development of the art on American railroads.

PRICE, \$2.00.

Published and For Sale by The Railroad Gazette, 73 Broadway, New York.

Fire-Proof Baker Car Heater.

MANUFACTURED ONLY BY

WM. C. BAKER,

799 Greenwich Street,
NEW YORK.

Five Hundred and Fifty
Fire-Proofs in Use.



Fire within a Safe like that on the Express Car. Jointless, one-fourth inch thick, Flexible Steel, that may be bent, buckled, but never broken.

Every First-Class Car should have it, where Safety, Comfort and Compactness are considered. In Jay Gould's Private Car, "Atlanta" (Old Style Baker Car Heater, and "Double-End," Steam Attachment removed); also in Private Car of President Roberts, of the Penn. R. R.; Vice-Pres. McCrea, of the Penn. Co.; Pres. Palmer, of the Rio Grande & Western; Pres. Felton, of the East Tenn., Va. & Ga. Ry.; Officers' Car, Cleveland, Akron & Columbus R. R.; General Manager McDowell, of the Louisville, New Albany & Chicago; J. V. Patton, Pittsburgh & Western; Payson Tucker, Maine Central; J. B. Haggis's Private Car; Pres. Inman, of Richmond & Danville, and others.

Northern Pacific has 117; Phil. & Reading, 70; Minneapolis, St. Paul & Sault Ste. Marie, 43; Can. Pacific, 48; Great Northern, 15.

BUSY MEN

will travel via the route that gives them the best service. What can equal the splendid time made by the Chicago, Rock Island & Pacific Ry. in a trip from Chicago to Denver. Just think! You can leave Chicago on the Great Rock Island Route, Big 5, at 10 p. m., and arrive at Denver at 7:40 a. m., second morning. This takes you away from business but one day to make this eleven hundred mile journey. You have a full day in Denver, and leaving on the



World's Fair Special, the "Rock Island" No. 6, at 8.10 p. m., arrive at Chicago at 7:45 a. m., second morning. This takes you from business for the whole trip but three days, and you have had

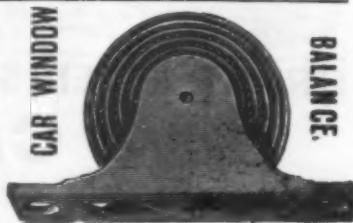
One Whole Day at Denver.

Remember this when figuring on a trip West
JOHN SEBASTIAN,
Gen. Ticket and Pass. Agt.,
Chicago, Ill.



RICHARD DUDGEON,
24 COLUMBIA ST., NEW YORK.
Maker and Patentee of
Improved Hydraulic JACKS.

PUNCHES,
BOILER-
TUBE EXPANDERS AND
DIRECT-ACTING
Steam Hammers.
Communications by letter will receive prompt attention.
Jacks for Pressing on Car
Wheels or Crank Pins made to order.



Factory:
289 to 261 Washington Ave.,
Allegheny, Pa.
For Passenger Coaches, Parlor and sleeping Cars
Used by the leading Railroads and Car-Builders
O. K. GARDNER, Mfr., P. O. Box 171, Pittsburgh, Pa.

**ROYAL
(FIRE)
INSURANCE COMPANY**
Of Liverpool, England.

ESTABLISHED 1845.

HEAD OFFICE METROPOLITAN DISTRICT,
No. 50 Wall St., New York.

TRUSTEES:
JACOB D. VERMILYE, HENRY PARISH
OSGOOD WELSH.
E. F. BEDDALL, Manager.
W. W. HENSHAW, Asst. Manager.

MAXON Pat. JACKS

Lever and Screw

Unequaled for all
varieties of

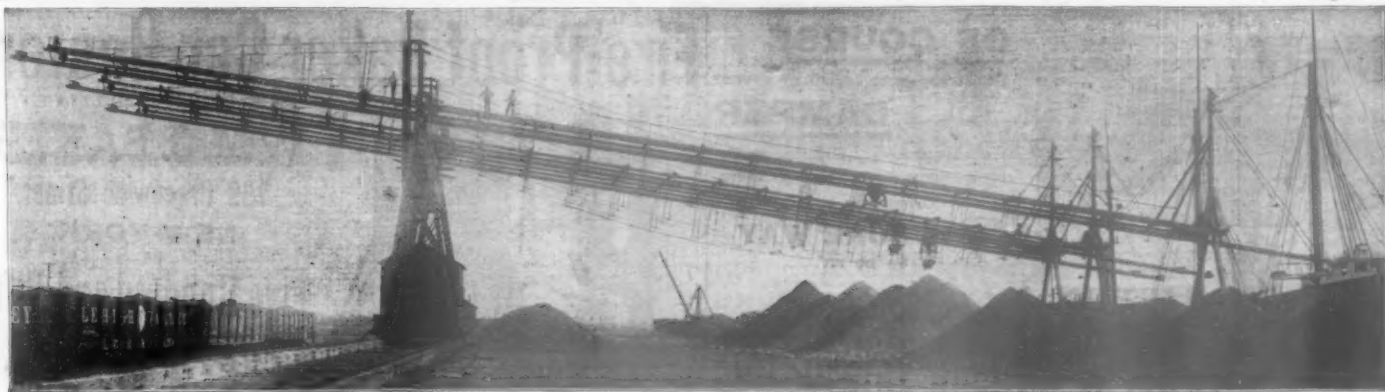
RAILROAD WORK.

Our Drop Track Jack
Beats anything of that
line now in market.

MANUFACTURED BY
**THE McSHERRY
MFG. CO.,**
DAYTON, OHIO

**BOUND VOLUMES OF THE
RAILROAD GAZETTE FOR 1891**

are now ready for delivery, price \$5 each, or subscribers can exchange complete files for bound volumes on payment of \$2. We can also supply bound volumes of previous years.



The Brown Patent Bridge Tramway Hoisting and Conveying Apparatus, as Applied to the Lehigh Valley R. R. Co.'s Docks, Buffalo, N. Y. Clear Span of Bridges, 180 feet. Cantilever Extension, 80 feet. Tramway Projection over Vessel, 36 feet. Height of Bridge at Front, 30 feet. Height of Bridge at Back Pier, 52 feet.

"THE BROWN HOIST"

Unloads and handles 75 PER CENT. of all iron ore received at the Lake Ports. It is the only system that properly handles coal with minimum breakage. Used by all large Railroad and Dock Companies.

Office and Works:
Cor. Hamilton & Belden Streets.

THE BROWN HOISTING & CONVEYING MACHINE CO., Cleveland, O.

THE DE LA VERGNE REFRIGERATING MACHINE COMPANY

Office and Works: Foot of East 138th St. (Port Morris), New York City.

MANUFACTURERS OF

REFRIGERATING AND ICE-MAKING MACHINES

AND OF

ANHYDROUS AMMONIA for the Same.

About 400 Machines now in successful operation, some of them representing the largest machines ever built. Total Capacity about 20,000 Tons of Ice Per Day. Send for either Refrigerating or Ice Making Circulars.

NEW YORK BELTING & PACKING CO.

(LIMITED),

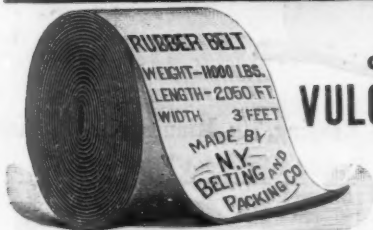
15 PARK ROW, NEW YORK.

JOHN H. CHEEVER, Manager.

Oldest and Largest Mfrs. in the U. S. of

VULCANIZED RUBBER FABRICS

For Mechanical Purposes.
RUBBER BELTING AND PACKING.
Westinghouse Air Brake Hose.
RUBBER CEMENT.



DRAKE & WEIRS, Cleveland, Ohio.

ASPHALT CAR ROOFING

The Cheapest, Best and Most Durable Car Roof Known. In use by Seventy Railroads. Twelve years successful use without a single failure. A new roof furnished free for every one that fails in ten years.



FIRE PROOF ROOFING

More durable than tin and less expensive. Requires no skilled labor in laying. Will not run or crack from heat or cold.

TEN YEARS IN USE.

Write for sample and circular.



EASTERN GRANITE ROOFING CO., JERSEY CITY, N. J.

HINSON DRAW-BAR ATTACHMENT, 506 The Rookery, Chicago.

This Attachment is in Satisfactory Use on a Large Number of Cars and Adopted as Standard by a Number of Companies.

For repairs on old cars we make a pattern with the holes to correspond with the ones now used in such cars, but for new work we prefer to furnish our standard

J. A. HINSON, President.

P. M. REAGAN, Secretary.

STREET RAILWAY FEED WIRES AND CABLES

THE BEST IS THE
CHEAPEST.



WE BACK UP OUR
GUARANTEES.

FEED WIRES manufactured under the above Trade Mark are THE BEST IN THE MARKET.

WILLARD L. CANDEE, } Mgrs.
D. DURANT CHEEVER, }
GEO. T. MANSON, Gen'l Supt.

THE OKONITE COMPANY,
LIMITED,
13 PARK ROW, NEW YORK.

O'NEIL'S

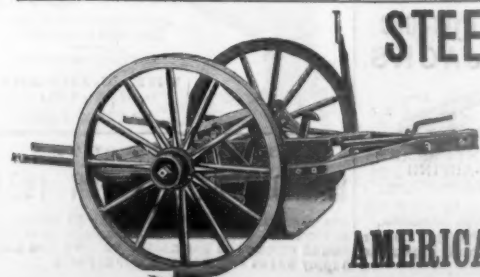
Automatic Highway Crossing Alarm

is in use on the New York, Chicago & St. Louis; New York, Lake Erie & Western; New York, Pennsylvania & Ohio; Chicago & Erie; Lake Shore & Michigan Southern; Chicago & Grand Trunk; Flint & Pere Marquette; New York, Susquehanna & Western; Colorado Midland; Toledo, Ann Arbor & North Michigan; Cincinnati, Jackson & Mackinaw; Baltimore & Ohio Southwestern; Pittsburgh & Western; New York & New England; Cincinnati, New Orleans & Texas Pacific, and other railroads.

Suitable for All Locations, Either Double or Single Track.

ELECTRIC SUPPLY & MFG. CO.,
113 Public Square, CLEVELAND, O.

JNO. W. CLARKE, Gen'l Western Agent, 470 The Rookery, Chicago, Ill.



STEEL SCRAPERS, PLOWS AND WHEELBARROWS

OF GREAT STRENGTH AND DURABILITY.

BUILT EXPRESSLY FOR CONTRACTORS.

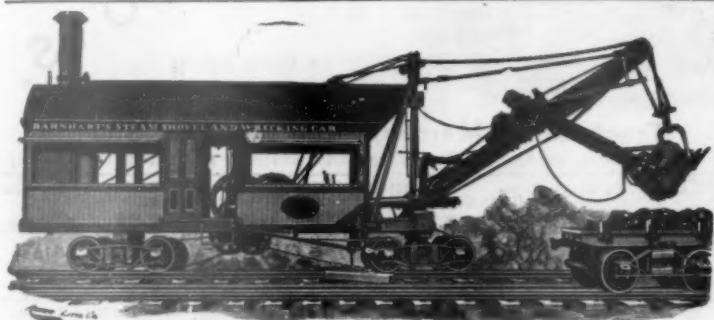
MANUFACTURED ONLY BY

AMERICAN STEEL SCRAPER CO., SIDNEY, O.



INDUSTRIAL WORKS,

BAY CITY, MICH.

NEW YORK AGENCY
OFFUTT & CO.,
Corner Church and Mector Streets.CHICAGO AGENCY
L. M. SLACK,
411 Phenix Building.**CRANES,****WRECKING CARS,****STEAM SHOVELS,****PILE DRIVERS,****RAIL SAWS,****TURN-TABLES,****TRANSFER TABLES,****FREIGHT CONVEYORS.**

One and One-half Yard Shovel.

MARION STEAM SHOVEL COMPANY

MANUFACTURERS OF

BARNHARDT'S PATENT STEAM SHOVELS, WRECKING CARS AND DREDGES
RAILROAD DITCHERS AND BALLAST UNLOADERS.All of our machines guaran-
teed to give entire satisfac-
tion, otherwise may be re-
turned at our expense.
For further information,
photographs, catalogues and
discounts address

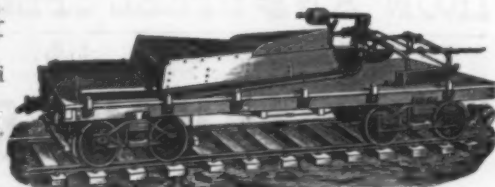
Marion Steam Shovel Co.,

595 West Centre Street

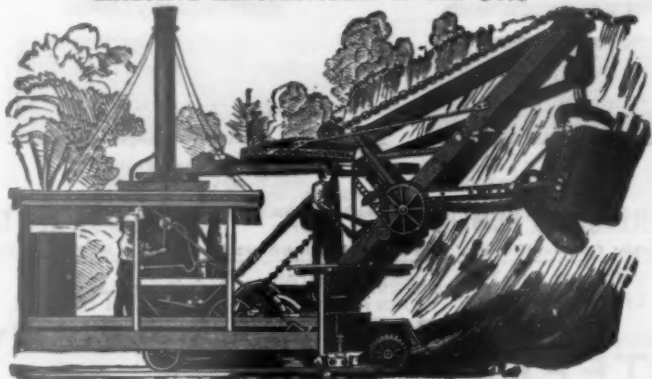
MARION, O.

San Francisco Office:

Geo. W. Barnhardt, 4 Sutter St.



Barnhardt's Patent Ballast Unloader.

JOHN SOUTHER & CO., BOSTON, MASS.,
EXCLUSIVE MANUFACTURERS OF THE OTIS**Patent Steam Excavators,**
WITH CHAPMAN'S IMPROVEMENTS AND DREDGES.**DREDGES & SHOVELS**STEAM DREDGES.
STEAM SHOVELS.

—FOR ALL PURPOSES.—

Bucyrus Steam Shovel & Dredge Co.,
BUCYRUS, OHIO.**Rock Drilling and Air Compressing****MACHINERY**

FOR

TUNNELS, QUARRIES, MINES, RAILROADS,

And Wherever Ore and Rock are to be drilled and blasted.

RAND DRILL CO.,

23 Park Place, - - - NEW YORK.

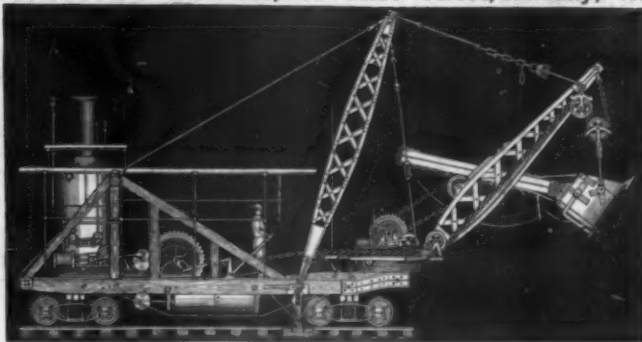
SPECIAL NOTICE.Two handsome photo-engraved display sheets en-
titled:

"Recent Improvements in Air Compressors."

"Recent Improvements in Rock Drills."

Mailed free to any one who will cut out this ad-
vertisement and mail it to us with his name and
address.**The Ingersoll-Sergeant Drill Co.,**

No. 10 PARK PLACE, NEW YORK.

OSGOOD DREDGE CO., 37 State Street, Albany, N. Y.No. 1.—Weight, 40 tons. Capacity
8 cubic yards per minute.No. 2.—Weight, 38 tons. Capacity
4 cubic yards per minute.STEAM EXCAVATOR AND DERRICK CAR
Aside from Our Standards (Nos. 1 and 2) we Build Machines of Special
Design, or from any Drawings Furnished.**THE UNIVERSAL
RADIAL DRILL CO.,**
CINCINNATI, O.,

Manufacturers Exclusively of

"Universal" and "Radial"

DRILLING

MACHINES,

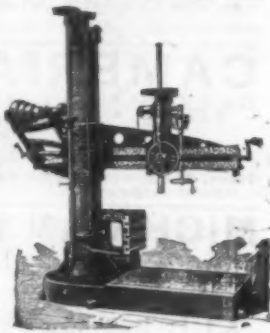
to Standard Gauges.

Prices upon

application.

Correspondence

solicited.

**THE NEW HIGH EXPLOSIVE****RACKAROCK**Furnished in two ingredients which are ab-
solutely unexplosive until combined by the
consumers, for which we furnish convenient
means. Shipped and stored as ordinary mer-
chandise. After combination the explosive is
absolutely safe. By reason of its safety it is
especially adapted to water-works construc-
tion in crowded streets.**Rendrock Powder Co.**

23 PARK PLACE, NEW YORK.

Car Pile Drivers.

SEND FOR CATALOGUE.

VULCAN IRON WORKS,
CHICAGO.

ILLINOIS STEEL COMPANY

Manufacturers of Bessemer, Foundry and Mill Pig Iron, Spiege and Ferro-Manganese; Iron Rods of any required chemical composition; Iron or Steel Car Truck Channels; Steel "I" Beams and Structural Shapes. Rolls for Standard Sections and Shapes always in stock. Special Sections and Shapes made to order.

BESSEMER STEEL RAILS

FROM 8 TO 100 LBS. PER YARD.

This Company owns and operates five works, namely: NORTH WORKS and UNION WORKS, Chicago; SOUTH WORKS, South Chicago; JOLIET WORKS; MILWAUKEE WORKS.
 JULIAN L. YALE, General Sales Agent, General Offices, "Rookery," Chicago, Ill. Milwaukee (Wis.) Office, 151 N. W. Ins. Building. New York Offices, 46 Wall Street. D. E. GARRISON & CO., Agents, St. Louis, Mo.

THE SPRINGFIELD IRON COMPANY,

SPRINGFIELD,
CHICAGO OFFICE:
710-711 Phenix Building.



ILLINOIS.
ST. LOUIS OFFICE:
125 and 127 Laclede Building.

IRON AND STEEL SPLICE BARS.

Track Bolts, Merchant Iron and Bar Steel.
The largest capacity and best facilities in the United States for making Angle Splice Bar

S. T. WELLMAN, President.
S. H. CHAUVENET, Vice-President.
JOHN P. CROZER, Treasurer.

C. H. WELLMAN, Superintendent.
RICHARD PETERS, Jr., Secretary.

WELLMAN IRON & STEEL CO.

—MANUFACTURERS OF—

Highest Grade Open Hearth Low Phosphorus
STEEL PLATE

For Fire-Box, Flange and Boiler Purposes.

PLATES UP TO 126 INCHES IN WIDTH.

GENERAL OFFICE AND WORKS, THURLOW, DEL. CO., PA.

CHICAGO, ILL.:
658 THE ROOKERY.
E. W. CRAMER, Agent.

NEW YORK, N. Y.:
7 NASSAU STREET.
J. H. BELCHER, Agent.

Norristown Steel Co.

Norristown, Pa.

Makers of the best quality of OPEN HEARTH STEEL CASTINGS of every variety up to 85 tons in weight, solid, free from blow-holes and equal to the best Steel Forgings. Rolls and all rolling mill castings a specialty. Correspondence Solicited.

CAMBRIA STEEL RAILS.

HEAVY RAILS, LIGHT RAILS AND RAIL FASTENINGS
STEEL CAR AXLES. STEEL CAR CHANNELS.

STREET RAILS.
ADDRESS: CAMBRIA IRON CO.,
Office, 218 South Fourth St., Philadelphia, Pa. Chicago Office: Phenix Buildings
(Works, Johnstown, Pa.)

MICHIGAN FORCE & IRON CO.,

No. 1 Newberry Bldg., Detroit, Mich.,
Manufacturers of

MERCHANT BAR IRON.

And all Kinds of

Car and Driving Axles, Links and Pins, Shafting and Forgings.

JAMES McMILLAN, Pres. HUGH McMILLAN Vice-Pres. W. C. McMILLAN, Gen. Man.
J. E. BAUGH, Gen. Sup't. S. A. BAUGH, Sup't. R. D. FIELD, Gen. W. ANDERSON, Treas.

UNION IRON WORKS,

SAN FRANCISCO, CAL.

Only Iron and Steel Ship Builders on
Pacific Coast.

MINING MACHINERY

A SPECIALTY.

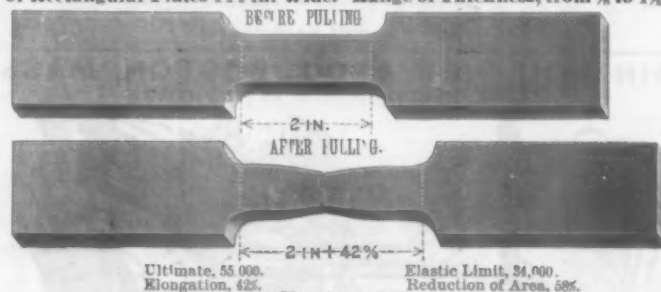
HYDRAULIC LIFT DOCK

CHARLES HUSTON, Pres. A. F. HUSTON, Vice-Pres. C. L. HUSTON, Gen. Man.
R. B. HAINES, Jr., Sec'y. JOS. HUMPTON, Treas.

LUKENS IRON & STEEL CO.

ESTABLISHED 1810. INCORPORATED 1890.

The First to Make Boiler Plates in America.
STEEL AND IRON PLATES.
Firebox Steel Plates a Specialty. We Can Roll Steel Circles 116 in. Diameter or Rectangular Plates 114 in. Wide. Range of Thickness, from 1/4 to 1 1/2 in.



COOLBAUGH & POMEROY, GENERAL RAILWAY 29 Broadway, New York.
AGENTS, Philadelphia Office: Rooms 62 & 64 Bullitt Bldg.

Boiler, Locomotive AND Smoke Stack **STEELS** FIRE BOX **STEEL** SOFTNESS, DUCTILITY AND PURITY.
QUALITY UNSURPASSED. Plates up to 100 inches in width. All Flange perfectly. Any tensile strength required. Ingots, Slabs and Blooms.
SHOENBERGER & CO., PITTSBURGH, PA.



METCALF, PAUL & CO

Make a Specialty of
SOLID STEEL

RAILROAD TRACK TOOLS.
ALSO SOLE MANUFACTURERS OF
THE PATENT VERONA NUT LOCK

SEND FOR OUR NEW CATALOGUE.
Western Warehouse:

7th Av. & LIBERTY ST., PITTSBURGH. 64 & 66 S. CLINTON ST., CHICAGO

THE FARIST STEEL COMPANY

JOEL FARIST, Pres.
GEO. WINDSOR, Sec. and Treas.

Manufacturers of all descriptions of
CAST STEEL, HAMMERED OR ROLLED.



SPIRAL AND ELLIPTIC CAR SPRINGS
RAILROAD AND MACHINERY FORGING.

CHICAGO: J. S. BREWER, 176 Jackson Street. Bridgeport, Conn. St. Louis: J. H. WYETH, 221 Chestnut St.

AARON FRENCH, Chairman. GEO W MORRIS, Gen. Man'r. D. C. NOBLE, Sec. and Treas.
JULIUS E. FRENCH, Vice Chairman.

THE A. FRENCH SPRING CO. LIMITED

PITTSBURGH, PENNA.

ELLIPTIC & SPIRAL SPRINGS

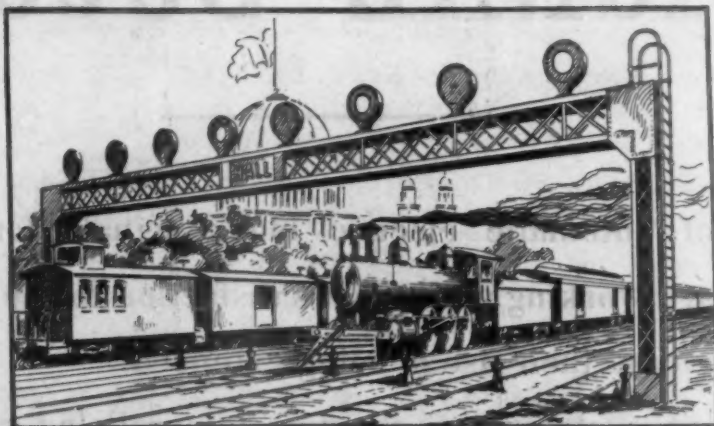
OF EVERY DESCRIPTION.

NEW YORK: 88 Canal Bldg. BOSTON: 82 Mason Bldg. CHICAGO: Phenix Bldg.

CH
for
T
C
C
C
b
C
S
S

W

WORLD'S COLUMBIAN EXPOSITION.



Hall Automatic Electric Block System on the
Illinois Central Railroad.

AFTER the most thorough investigation ever made into the subject of block signals THE ILLINOIS CENTRAL RAILROAD COMPANY HAS ADOPTED THE HALL SYSTEM OF AUTOMATIC ELECTRIC SIGNALS for the protection of their entire WORLD'S FAIR TRAFFIC on their eight tracks from CHICAGO to GRAND CROSSING and four tracks from GRAND CROSSING to KENSINGTON.

THE CHICAGO AND NORTHWESTERN RAILWAY COMPANY HAS ADOPTED THE HALL SYSTEM for the block signaling of their Galena, Milwaukee and Wisconsin divisions, 87 miles of double track, 201 block signals, and also providing protection for 188 switches.

THE HALL SIGNAL COMPANY.

WILLIAM P. HALL, President.

S. MARSH YOUNG, General Agent.

HENRY BEZER, Mechanical Signal Engineer.

W. S. GILMORE, Treasurer.

C. W. BREWSTER, Sales Agent.

A. J. WILSON, Sup't Electrical Construction.

W. W. SALMON, Signal Engineer.

MELVILLE P. HALL, Secretary.

*General Offices, 50 BROADWAY, NEW YORK.
Western Office, 340 THE ROOKERY, CHICAGO, ILLS.*

A SIGNAL SUCCESS.

OUR SYSTEMS of automatic electric block signals (on wire and rail circuits) are working with great satisfaction to the railroad companies using them, and in almost every case their use is being extended.

Our new rail-circuit systems are showing unparalleled results. Eleven of these signals, on a certain road, have been operating over seven months with a record of but four train stops (caused otherwise than by trains in block and open switches), and these were due to signals being struck by lightning, one broken battery jar and to one broken rail. They have also operated with **ABSOLUTE RELIABILITY**. From the reports of railroad companies using other rail-circuit signals, we are justified in claiming that no such good results (or records) have ever before been shown.

Having substantiated our claims to the complete satisfaction of many leading railroad officials, we are now engaged in applying the systems on several new lines, and we are also engaged in preparing **PLANS AND ESTIMATES FOR THE APPLICATION OF THE SIGNALS FOR MANY OTHER COMPANIES**, several of whom do not consider any other signal than

THE HALL.

We pride ourselves on the excellent and honest character of our work, and beg to assure all who deal with us that they will be fairly and squarely treated, and always with the assurance of satisfaction. All correspondence that may be addressed to our New York or Chicago office will receive careful and immediate attention, and any inquiries on any subject relating to our specialties will command the professional knowledge and skill of our engineering department.

THE HALL SIGNAL COMPANY,

50 Broadway, New York.

340 The Rookery, Chicago.

WILLIAM P. HALL, President.
S. MARSH YOUNG, General Agent.
G. W. BREWSTER, Sales Agent.
HENRY BEZER, Mechanical Signal Engineer.

W. S. GILMORE, Treasurer.
MELVILLE P. HALL, Secretary.
A. J. WILSON, Sup't Electrical Construction.
W. W. SALMON, Signal Engineer.

its)

ing

ese

four

ere

rail.

om-

ults

road

also

MANY

re all

ce of

e will

alties

ngo.

n.

circuits)

panies using

of these

of but four

these were

broken rail.

road com-

ood results

ing railroad

we are also

FOR MANY

to assure all

assurance of

go office will

our specialties

Chicago.

Construction.

THE KINSMAN BLOCK SYSTEM COMPANY, CENTRAL BUILDING.

LIBERTY STREET, NEW YORK.

"IT IS A FACT THAT A SIGNAL WILL NOT OF ITSELF STOP A TRAIN;
IT MUST BE OBSERVED AND OBEYED; PER CONTRA, A SIGNAL NOT GIVEN,
OR A SIGNAL OBSCURED BY FOG OR OTHER CAUSES, LEAVES THE MOST
CAREFUL ENGINEER IN AN UTTERLY UNPROTECTED POSITION."

KELSEY RAILROAD SIGNAL COMPANY.

A. G. HILL, Treas. and Gen. Man.

F. N. KELSEY, Gen. Supt. and Man. of Works.

Works, FLORENCE, MASS., U. S. A.



WE CLAIM and
KNOW that we
have the ONLY per-
fect single track block
system. Cheap, reli-
able. Fully protects
life and property. In
successful operation
on Erie lines west of
Salamanca.



JAMES T. HALSEY
26th and Callowhill Sts., PHILADELPHIA.



ROBERT GILLHAM, Pres. W. W. ALEXANDER, Vice-Prest. M. C. GILLHAM, Secy. & Treas.

E. R. GILL, General Manager and Electrician.

INDIVIDUAL TELEGRAPH CALL BELL SYSTEM

Gill-Alexander Electric Manufacturing Co., Kansas City, Mo.

Patented and Patents Pending.

This new method of calling telegraph operators by a ringing bell is a valuable equipment for railway telegraph wires. Its use effects a saving of expense at many stations, and makes it possible to handle a larger volume of business with a fewer agents. All stations may be day and night offices with a single operator, and can be reached at any time with absolute certainty. It is of great value to the train dispatcher in the economical and safe handling of trains. The call requires but one sending, and is contained at the office desired without the use of the line circuit. The instrument works in the local circuit without interference with the sounder and without extra battery.

The Union Pacific Railway has used our instruments since August, 1890, with absolute success, and other railroads are using them with equal satisfaction. It is the only practical individual telegraph call bell yet invented.

We rent the instruments at a monthly rental, and guarantee maintenance. Complete information given on application. Correspondence is solicited.

Stow Flexible Shaft Co., Limited,

26th, Callowhill and
Biddle Sts., Phila., Pa.
Manufacturers of

FLEXIBLE SHAFTS,

And all kinds of Machines
to be used with them.
Portable Drilling, Tapping,
Reaming and Boring Ma-
chines. Also Portable
tools for em-
ery wheel
grinding,
metal and
wood pol-
ishing, cat-
tle brushing
and clip-
ping, etc.

Builders of Special Machines for Railroads,
Bridge and Hoiler Makers, Contrac-
tors, etc.

DETROIT LUBRICATOR CO.'S

STANDARD

Locomotive Appliances.

DOUBLE and TRIPLE

SIGHT-FEED CYLINDER

—AND—

AIR PUMP LUBRICATORS.

Garfield Injectors.

Pendry Throttle Valve,

ROD AND GUIDE CUPS.

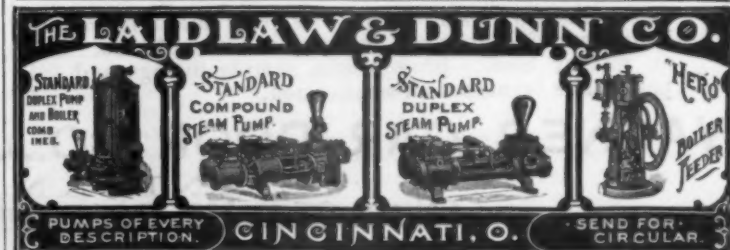
Address

Detroit Lubricator Co.

DETROIT, MICH.

BOLT CUTTERS

Schlenker's Automatic Bolt Cutters
and Screw-Cutting Machines.
HOWARD IRON WORKS, BUFFALO, N. Y.
Established 1845.



Important to Railroad Managers and Master Mechanics.

SIBLEY'S

PERFECTION VALVE OIL.

More perfect lubrication insured, and entire
freedom guaranteed from corrosion of cylinders
and destruction of steam joints by fatty acid.
In exclusive use on 50 railroads.

References and prices furnished upon appli-
cation.

Make exclusive specialty of the
Manufacture of Valve and Signal Oil
for Railroad use.

SIGNAL OIL WORKS

(Limited).

FRANKLIN, PA.

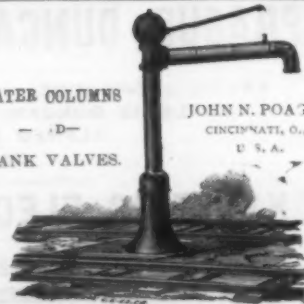
J. C. SIBLEY,

PRESIDENT.

WATER COLUMNS

JOHN N. POAGE,
CINCINNATI, O.,
U. S. A.

TANK VALVES.



THE LEHIGH VALLEY CREOSOTING WORKS

Works, Perth Amboy, N. J.

Office Washington St., So. of Gap, Jersey City, N. J.
H. STANLEY GOODWIN, Pres. WALTER G. HICKS, Engr.
H. CONER, Supt.

Lumber, Piling and Ties creosoted with DEAD
OIL OF COAL TAR. Creosoted timber furnished.
Capacity, 400,000 ft. B. M. per month. Cylinders 80
ft. long. Direct water and rail communication.

WORTHINGTON STEAM PUMPS

For RAILWAY WATER SUPPLY.

FIRE PUMPS, TANK PUMPS,

BOILER FEED PUMPS,

GAS HOUSE OIL PUMPS,

Water Meters, Oil Meters.

HENRY R. WORTHINGTON,

86 & 88 Liberty St. and 145 Broadway,

NEW YORK.

70 Kilby St., BOSTON. 907 Arch St., PHILADELPHIA. 93 & 95 Lake St., CHICAGO.
404-406 Walnut St., ST. LOUIS. 1338 Sibley St., ST. PAUL.

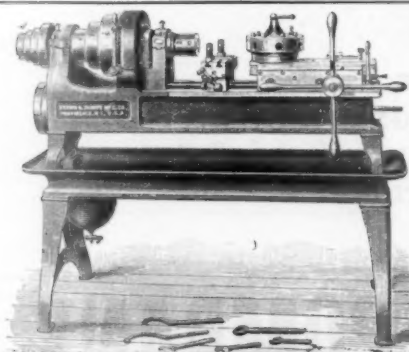


R. D. WOOD & Co. Engineers,
Iron Founders,
Machinists,
PHILADELPHIA, PA.

**CAST IRON PIPES.
HYDRAULIC TRAVELING CRANES.**

Hydraulic Cranes, Presses, etc. Hydraulic Car and Freight Lifts.

HEAVY LOAM AND MACHINERY CASTINGS.



**Brown & Sharpe
Mfg. Co.,**

PROVIDENCE, R. I.

SCREW OR TURRET

Head Machines.

**On Your Air
Brakes.**

USE THE *Mason*
Pressure Regulator
FOR STEAM PUMPS

The Pennsylvania, Rock Island, R. & D., Boston & Albany,
Fitchburg, and other large systems use them.

MASON REGULATOR COMPANY,
BOSTON

CRANES OF ALL TYPES
Particulars
on Application

THE YALE & TOWNE MFG CO., Stamford Conn.
NEW YORK. CHICAGO. PHILADELPHIA. BOSTON.

Facts on Varnish.

NO. 107.—CONDENSED EXPERIENCE.

A proverb or two may be good
for the paint-shop.

Here's one, not patented: Save
on your varnish and double your
trouble.

MURPHY VARNISH COMPANY.

FRANKLIN MURPHY, President.

Head Office: Newark, N. J.

Other Offices: Boston, Cleveland, St. Louis and Chicago.

Factories: Newark and Chicago.

SERVIS TIE PLATES

THE Q AND C CO. CHICAGO AND NEW YORK. The Q and C Co. Chicago & New York. THE Q AND C CO. CHICAGO AND NEW YORK.

Wagner Car Door.

Sets in flush with side of car. Its great merit proven by long years of continuous use on thousands of cars. Sold on royalty basis. Blue prints, sample fittings and full particulars furnished on application.

WAGNER CAR DOOR CO.,

INDIANAPOLIS.

Chicago Office, 323 Phenix Building. ED. J. EAMES, Agent.

American Flush Car Door.

Sets in flush with side of car. Runs on rollers. Absolutely tight car; utmost ease of motion. We furnish the fittings for this door out of refined malleable iron. Blue prints sample fittings and full particulars furnished on application.

AMERICAN CAR DOOR CO.

SPRAGUE, DUNCAN & HUTCHINSON,

Limited.

FRANK J. SPRAGUE,
LOUIS DUNCAN, Ph. D.,
ALFRED BISHOP MASON,
CARY T. HUTCHINSON, Ph. D.

CONSULTING ELECTRICAL ENGINEERS.

15 WALL STREET, NEW YORK.

ARTIFICIAL STONE AND ASPHALT PAVEMENTS

ESPECIALLY ADAPTED FOR RAILWAY STATION PLATFORMS, ROUND HOUSES, FLOORS IN SHOPS, ETC.
REFERENCES: PENNSYLVANIA RAILROAD CO. ADAMS EXPRESS CO.
WEHN PAVEMENT CO.,
16 & 18 EXCHANGE PLACE, NEW YORK

EDWARD SMITH & CO., RAILWAY VARNISHES Times Building.

H. W. JOHNS'



**Asbestos
Sectional
Pipe
Coverings.**

Non-Conducting Coverings for Steam and Hot Water Pipes, Boilers, etc.

READILY ATTACHED OR REMOVED BY ANY ONE.

ASBESTOS BOILER COVERINGS.

We are prepared to take contracts for applying Steam Pipe and Boiler Coverings in all part of the United States.

H. W. JOHNS MANUFACTURING COMPANY,
Sole Manufacturers of H. W. Johns' Asbestos Millboard, Sheathings, Building Felts, Fire-Proof Paints, Liquid Paints, Asbestos Roofing, etc.
87 MAIDEN LANE, NEW YORK. CHICAGO, PHILADELPHIA, BOSTON, ATLANTA.

TRAUTWINE'S POCKET BOOK.

"The most useful hand-book in the language for the engineering profession."—Engineering and Mining Journal, Aug. 25, 1888.

SEND FOR SAMPLES.

SOLID BRAIDED BELL CORD.

Air Brake Cord. Engine Bell Cord.
Sash Cord. Arc Lamp Cord.

SAMSON CORDAGE WORKS, 115 Congress Street, Boston.



FRIDAY, JUNE 3.

CONTENTS.

ILLUSTRATIONS:	PAGE.	PAGE.
Proposed Elevation of Illinois Central Tracks in Chicago.....	405	Bridge Building.....
Rod Brass Joining Machine.....	405	Meetings and Announcements.....
Test's Piston Rod Renover.....	406	Personal.....
Bridge at Woodlawn Junction of the New Haven and the Harlem Roads.....	406	Elections and Appointments.....
Draft Gear for Freight Cars.....	408	Railroad Construction.....
Punching and Shearing Machine.....	410	General Railroad News.....
Pressed Steel Coal Car.....	411	Traffic.....
CONTRIBUTIONS:		MISCELLANEOUS:
Roller Bearings.....	405	Technical.....
Simple vs. Complex Night Signals.....	408	The Scrap Heap.....
The M. C. B. Rules of Interchange.....	408	The Foundations of the Seventh Avenue Bridge, New York.....
The Best Metal for Brake Shoes.....	408	Opening the Chicago "Alley" Elevated Road.....
EDITORIALS:		The American Society of Mechanical Engineers.....
Quick and Slow Acting Brakes.....	412	Illinois Central Passenger Cars for the World's Fair Traffic.....
What is the Interstate Commerce Law Good For?.....	418	The New York Rapid Transit Commission.....
High Speed Electric Railroads and Air Pressure.....	418	Electric Locomotives for Short Steam Roads.....
EDITORIAL NOTES.....	412, 414	Change of Gauge on the Great Western of England.....
NEW PUBLICATIONS.....	414	The Fontaine Continuous Railroad Crossing.....
TRADE CATALOGUES.....	414	The Franklin Institute on the Rhode Island Comp. and Locomotives.....
GENERAL NEWS:		Smokeless Locomotives.....
Locomotive Building.....	416	The Monier System of Iron and Cement Construction.....
Car Building.....	416	

Contributions.

Roller Bearings.

WEST TROY, N. Y., May 31, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I desire to thank you for the appreciative tone of your review of the recent discussion by the New York Rail Road Club on the subject of Roller Bearings.

Sufficient time has not elapsed since the successful development of bearings of this type to afford extended opportunity for noting results, and hence it is not surprising that there is considerable difference of opinion among practical railroad men as to their value.

Owing to the difficulty of making reliable dynamometric tests during actual running, we can furnish no other data than that afforded by comparative gravity and fuel consumption tests, supplemented by static tests showing that the Menely tubular bearing enables a car to be moved with but from 10 to 15 percent. of the power required with ordinary brasses on a level track. This variation being due, not to difference in draught of the tubular bearings, but to the condition and state of lubrication of the brasses.

While it may be a question as to what extent this initial ease of movement accelerates the movement of trains, the writer does not assent to the conclusion that it is less effective in a rapid start than in starting slowly. The ultimate speed of a train cannot be attained at a bound, and it would seem that a uniform obviation of from 85 to 90 per cent. of static resistance would effect uniform results, at the moment of starting, with all trains. While the principal advantages realized from the use of these bearings are the saving in motive power and fuel, together with the higher speed which they render possible, a proper estimate of their value requires that other important advantages which they secure shall also be taken into account. Among these may be mentioned the obviation of the expense of constant and copious lubrication, and the attendant results of cleanly tracks and running gear; the large reduction in wear (eighteen months of constant running producing no other effect upon the rollers, or the axle journals upon which they rest, than a mere polish of their surfaces) and the consequent absolute avoidance of frictional heating. The latter advantage alone is, perhaps, equal in value, though in another way, to the saving in motive power.

Already has the growing traffic upon our principal lines of railroad become congested, nor do the limitations of the present gauge admit of any appreciable enlargement of capacity other than by the multiplication of trains. The demand for more rapid transit—not only between cities and their suburbs, but between all parts of the country—adds a new complication to the railroad problem, and renders still more valuable any device that will measurably lighten the burden of transportation.

GEO. R. MENEELY,
President Menely Bearing Co.

Simple vs. Complex Night Signals.

BOSTON, May 30, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Does your correspondent of the facetious pseudonym *look forward* from his covert with the pleasing anticipation of seeing his less fortunate brothers punch each others' heads over the question of night signals? Doomed, doubtless, to disappointment, let us hope that the balm of editorial consolation may still be his.

While I must leave "R. C. E." to look out for himself as regards his scheme of obscuring red signals, which, I

frankly confess, seems to me but adding to the color muddle, already sufficiently confused, permit me to further defend my own position in favor of showing a *semaphore* form of signal by night as well as by day.

1. *Consistency*.—This is the jewel which the signal people all profess not only to be anxiously looking for, but to sincerely admire.

2. *Visibility*.—On a recent test of Koyl blades, in company with the engineer of signals of a leading western road, we found the red (horizontal) night signal visible for 6,000 ft., and that this distance is far enough, your own unanswerable argument, in the editorial columns of last week's issue, abundantly confirms. Enginemen should not get accustomed to long notice (with the risk of overlooking change of signal meantime), but should get their word of command immediately before they are to execute it, and in no uncertain terms.

3. *Distinctiveness*: clearness and certainty of meaning. A light too strong and brilliant, especially if direct instead of reflected, produces the well known phenomena of irradiation and change of form (which is what Dr. Jeffries probably alludes to), but it would indeed be ridiculous to insist on merely unnecessary intensity, valuable in pyrotechnics, but not in railroad signaling.

4. *Simplicity and Economy of Maintenance*.—If position by night is to be indicated, at least three lights must be used for each signal, by the usual system; the Koyl uses but one, which brightly illuminates each position of the arm, combined with its proper color.

The writer, in company with the signal engineer above mentioned, was recently present at an investigation on one of our eastern roads where an engineman had taken the wrong diverging main route (signaled by two arms on one post; a double distant signal would seem proper in such cases). It was night, the distant signal was set in the clear position, but it did not indicate which route was meant. The tower-man erroneously gave the left-hand route, the upper home signal was against the engineman, and his train went over the switch to the left instead of the right. In this case he had to see four lights and to determine in short time which of the two patterns meant his route; whether two vertical green lights above two horizontal red lights, or two vertical green lights below two horizontal red lights were for him or not, might mean life or death to himself and passengers. He on this occasion decided (I wrongly, or else forgot the combination. Curiously enough, he testified that the signals stood exactly opposite to the position they must have been in. Here is where the illuminated form-signal by night, identical with that by day, proves its right to exist.

5. With regard to signal colors, if (as is the case with the illuminated semaphore) white for "all clear" can be made distinctive and unmistakable, I favor it, not only for that reason, but also in order to retain three good and well-tried colors for safety, caution and danger.

Now, I am but a plain man, and no one has ever excused his tears by accusing any eloquence of mine as their cause, but it won't do to let our old fogysm (of which we all have a share, perhaps) pooh-pooh every substantial improvement, without even attempting to face good facts and good logic. As for prowlers and "boomerangs" (I thank thee, Jew, for that word, let the other fellows look out for boomerangs, which are meant to strike and kill (even at a distance), and then to return harmlessly to their owner,—on the whole, quite a satisfactory kind of weapon.

C. A. HAMMOND.

The M. C. B. Rules of Interchange.

BOSTON, May 30.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It may be asked with propriety, what is the object of the M. C. B. Code of Rules if not to equally proportion the expense of keeping up the running repairs of the cars in service in interstate traffic, so that each road shall bear its just proportion of the expense. If the expense is justly proportioned, ought not the cost for repairs of freight cars per mile run to be the same for all roads doing interstate business? It is difficult to see why the expense should not be reasonably uniform, and yet an investigation in regard to the expense per mile run for repairs to freight cars of several railroads develops the fact that it varies materially. The average cost (in dollars) of repairs to freight cars for 11 roads is given below.

Railroad.	Average cost per mile run. 1889.	Average cost per mile run. 1890.	Average cost per mile run. 1891.	Total average.
No. 1.....	.0023	.2259	.2073	.1751
" 2.....	.1206	.1272	.1047	.1175
" 3.....	.0718	.0381	.0726	.0601
" 4.....	.3154	.2149	.2219	.2507
" 5.....	.1017	.1141	.0849	.1016
" 6.....	.0772	.0781	.0785	.0779
" 7.....	.1077	.0923	.0712	.0904
" 8.....	.1084	.1071	.1253	.1136
" 9.....	.1944	.1701	.1465	.1723
" 10.....	.1529	.1314	.1402	.1615
" 11.....	.0675	.0504	.0715	.0641
Total average.	.1281	.1285	.1210	.1258

It is a singular fact that the average for each year of the 11 roads is just 12 cents and a fraction, while the average cost for each road varies from 6 to 25 cents per mile run. The difference between the lowest and highest cost involves several hundred thousand dollars a year to the roads in question.

The revenue derived from this traffic is pro-rated between the roads in interest; why should not the expense of repairs attending this traffic be pro-rated also? The inducement to shift this burden from one road to another should in some way be removed. This would seem to be an easy matter if every one was disposed to deal fairly.

Rule 8, while it does not ameliorate all the difficulties under which interchange traffic is conducted, is nevertheless a step which aims in the right direction. A railroad which pays for 10 miles run by foreign cars on its road to every five miles run by its cars on foreign roads is called upon to do twice the amount of running repairs on foreign cars as is done by foreign roads on its cars, other conditions being equal. Rule 8 aims to equalize the expense and place it where it justly belongs. It is true that its provisions are much too narrow to accomplish all it aims at. It covers only a part of the material which is subject to wear and tear and must be frequently renewed. The rule should be more definite in its provisions. The labor charge should be made uniform for applying brasses and brake-shoes, and article (d) should be more clearly defined. As it now reads one is in doubt whether hangers or other attachments to body bolsters and springs planks can be properly charged.

Private line companies claim exemption from the expenses of running repairs and are very belligerent and troublesome. Why they take this attitude it seems hard to determine. It is perhaps safe to estimate that private line cars make over the trunk lines one-eighth of the mileage made and possibly more.

I believe the only way to do exact justice to all interested would be to pro-rate the expenses for repairs to cars running in interchange service. This would require all cars in line service to have a uniform mark, so that the repairs could be kept in a distinct account. This would not seem to be a difficult matter, but the time for such an innovation upon ancient customs has not yet arrived, and until that time comes the just enforcement of the provisions of Rule 8 will without question result in throwing the burdens in a measure where they belong.

It must be clear to the mind of every practical man that many thousands of dollars are held in the wrong treasury by means of evading the payment of expenses for repairs. It is possible under the present system for a road to get along without doing much repairs to its own cars, depending on its connections to do the repairs for them. The private line companies seem determined to evade this payment if possible, but insist on good pay and mileage for the use of their cars. The private line companies do not maintain a roadway, neither do they maintain the running repairs to their own equipment except in a very slight degree, where a few railroads compel them to pay for certain slight repairs. Equal treatment would compel private line companies to pay the proportion of all the operating expenses of the roads over which they run, based upon the mileage of the cars; this would be the only equitable way. They are treated the same as cars owned by railroads in the matter of rates paid for mileage as I understand the matter; why, then, should they not bear their proportion of the expense of maintaining the roadway and equipment, etc.? The private line companies now have a very comfortable arrangement under the rules of interchange, and it would seem that they ought to appreciate it, and instead of making the roads all the trouble they can to collect the mere fraction of what they are justly entitled to, promptly cancel all their obligations which are imposed under the M. C. B. Code of Rules.

In theory it seems easy to accomplish all that has been suggested, but practically, speaking exclusively of the relation of railroad companies with each other, in the matter of repairs under Rule 8, it is not so easy as it would seem to carry out the provisions of Rule 8 economically under present conditions. Inspectors are not clerical men and it is difficult to get them to make their reports correctly, and much time is consumed in making the proper reports which might be more valuably spent in making the proper inspection, and as each road reciprocates, or should be compelled to under the proper inspection, in the matter of repairs, the difference of the expense owing to a difference in mileage made might not be enough to compensate for the neglect of inspectors to properly inspect the cars owing to their attention being occupied by the clerical work for which they are not fitted. This is a complicated question and can only be settled equitably by the joint action of the mechanical, transportation and operating departments.

SYNTAX.

The Best Metal for Brake Shoes.

CHICAGO, May 28, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

What will be the verdict of the M. C. B. Committee as to the best metal for brake shoes? If we judge by the prevailing opinion among railroad men, the answer will be soft cast iron. The reasons are clear:

First—It is the cheapest material available.
Second—It gives a high coefficient of friction on both iron and steel.

Third—The friction is greatest at the instant of application, and falls slightly as the shoe warms, for the reason that the particles of the shoe are more rapidly detached after the shoe is heated. The detached particles roll between the shoe and the wheel.

Fourth—Soft cast iron is a material that can be made

in any foundry and can be reproduced anywhere with any standard degree of hardness. A uniform braking power can only be obtained by having a uniform material for brake shoes, and therefore it is evident that the best material for brake shoes is one that can be made by any foundrymen of a standard hardness.

It is, of course, impossible to prevent heating, and the best that can be done is to use such material for shoes as will reduce the evil results of heating to a minimum. The one great evil is in the case of some materials that harden after heating, and thereafter cut the wheel. This is not true of soft cast iron shoes, and therefore they fill the requirements better than anything else discovered to date.

Although cast iron is exceedingly satisfactory for brake shoes from the nature of its action in braking yet such shoes are losing much of their former prestige, on account of the rapid wear which adds so much to the cost of keeping up the equipment. To reduce this rapid wear there have been many attempts, and the numerous patents in the government office at Washington bear witness to the efforts to find a substitute for the plain cast iron shoe. The Congdon has been used most extensively. This type of shoe is made of soft cast iron with blocks of wrought iron set in the face and so surrounded by cast iron as to greatly increase the life of the shoes while retaining all of the advantages of plain cast iron. About 40 per cent. of the surface of the shoe is wrought iron. In action the particles of cast iron detached from the shoe pass over the entire surface of the wrought iron. It has been found to be most valuable for chilled wheels and has been used to some extent on steel tires; but there is a strong feeling against its use on steel owing to the cutting or dressing effect due to the collection of the granular particles of cast iron on the wrought iron surfaces which then act like emery paper in wearing the steel.

After the improvements in material which reduce the wear of the shoes, attention was turned to the wear of wheels by the rails, as the wear of steel tires was serious, and the strong objection to the high and "double flanges" on tires soon demanded a remedy other than the lathe. The Ross shoe met this demand by providing a bearing on the flange and on that portion of the tread untouched by the rail, whereby the shoe is made to wear the tire where the rail does not, and assist in maintaining the original profile. The value of this shape is attested by its use on almost all the driving wheels and many steel-tired coach wheels in this country. In some cases the excessive rail wear on steel tires demanded a greater dressing effect than that furnished by the Ross cast iron shoe.

The Ross shoe of plain cast iron was found to have insufficient dressing effect to keep pace with the rail wear on driving tires, and the Meehan improvement was introduced. It consists of pieces of crucible steel set into the Ross shoe where it bears on the tire. These pieces, in combination with the cast iron, assist in wearing the tire more rapidly than the shoe of plain cast iron. Instead of the crucible cast steel pieces wrought iron was first introduced, but with indifferent success, and it was only after much experiment that the present Ross-Meehan shoe was produced.

The Ross-Meehan shoe is to-day pre-eminently the driving brake shoe. It is used as a standard on the leading railroads. That this shoe is a tire dresser is indicated by its action on the small steel tired wheels under coaches, more particularly on suburban runs and on heavy mountain grades where, in several instances, the shoes have proved too severe, cutting down the flange and outside tread in excess of the rail wear.

The small coach wheels are more affected by the brakes than the larger driving wheels, owing to the fact that in a given length of run during the application of the brakes the same point on the small wheels comes in contact with the shoe a greater number of times. This naturally causes the small wheels to be more affected by the shoes than the larger ones.

To prevent excessive wear by the flange brake shoes with the crucible steel pieces, such as the Ross-Meehan just described, another type of shoe has been introduced known as the "Meehan." This is a shoe of cast iron, having a bearing all the way across the tread and flange, but with the steel pieces imbedded in the flange, and also where the shoe bears on the outside of the tread. The increased surface of the cast iron, bearing as it does all over the tread, decomposes materially the dressing tendency of the composite portion. The results of trials during some years have shown that the "Meehan" shoe is for steel tired coach wheels fully as satisfactory as the "Ross-Meehan" shoe is for driving wheels. The "Meehan" shoe has established a record of usefulness on chilled wheels also, as it bears all across the tread, and therefore heats the wheel uniformly and reduces the danger of cracked wheels. This shoe, of course, always takes the same position on the wheel, and therefore lessens the tendency toward sharp flanges. By reason of the flanges on the shoes, the brake beams are stiffened vertically, as the beams cannot break down in the centre without twisting the shoes off the wheels, and as they have no tendency to bend down except when the brake shoes are applied, there is a manifest increase in vertical stiffness by the use of a flanged brake shoe. The relative durability of the "Meehan" shoe and the plain cast iron shoe is at least six to one.

There is another type of shoe designed to supplement

the Ross-Meehan where it is desirable to cut down the outside tread and the flanges quickly; it is known as the Corundum shoe. In shape it is the same as the Ross-Meehan, but most of the crucible steel pieces are replaced by blocks of vitrified corundum. On switching engines this shoe will cut the flange and outside tread faster than any other type, and it is this that makes it especially valuable for switching service.

All the brake shoes mentioned here have a body of soft cast iron, a large portion of which projects to the surface of the shoe. By soft cast iron is meant a non-chilling iron of fine grain which can readily be machined. The advantage of the composite shoes is believed to be due to the fact that there is a grinding action of the particles of cast iron rolling between the shoe and the wheel, these particles being retarded more or less by the steel pieces, and by mingling with the emery of the corundum shoe grind the tire. They are what might be termed "grinding" shoes and possess to a maximum extent the advantages which we have assumed to be those that will influence the Master Car Builders' committee to decide that soft cast iron is the best metal for brake shoes.

The result of experience, as well as the laboratory tests published, have shown that soft cast iron possesses the most desirable properties for brake shoes, except that of endurance, and the "grinding" shoes just described retain a maximum of these benefits with the added advantages of great endurance and cutting action.

DURABILITY.

The Foundations of the Seventh Avenue Bridge, New York.

BY DANIEL E. MORAN.

The old combination pivot drawbridge over the Harlem River at 155th Street and Seventh Avenue, commonly called the McComb's Dam Bridge, now being replaced by a modern steel structure, is one of the old landmarks of the city. It crossed the river obliquely, taking advantage of high banks on both sides, and also of a reef of rocks in the channel. This gave easy foundations, and altogether a very advantageous crossing. The bridge connected the old McComb's Dam road with Jerome Avenue, and was a very important one to the public that drives.

The new bridge connects McComb's Dam road and Jerome Avenue, and also connects on the New York side with an important viaduct on 155th Street. This viaduct, which is now nearly completed, connects the bridge with the high land at Edgecombe Avenue. On the Westchester shore a connection is made with Ogden Avenue.

The importance of the bridge, the large volume of traffic expected and its central location, all justify a large expenditure to produce the best results possible, architecturally, structurally and in point of capacity. These conditions have been met in the design by making wide roadways and sidewalks on the approaches and bridge proper, by carrying out the general design in a substantial and permanent manner, and by a judicious use of ornament on the superstructure and piers. The drawspan is 43 ft. 6 in. c. to c. of trusses with overhanging sidewalks making it nearly 70 ft. out to out in width. The approaches are 61 ft. 8 in. wide.

The location of the new bridge differs from that of the old. The starting point on the Manhattan Island shore is the same, but the Government Channel is crossed at right angles, throwing the line 180 ft. to the right of the old bridge at the Westchester bulkhead line. This puts the shore pier of the pivot span in a swampy lying between an arm of the Harlem called Cromwell Creek and the high bank which the old location followed.

From this pier (No. III) the line of the Jerome Avenue approach continues through the swamp straight for 448 ft., and then curving to the left with a radius of 1,500 ft. for 1,205 ft., finally striking grade at Jerome Avenue and East 162d Street. There are 15 piers in this swamp between Pier III and the abutment at East 161st Street. These carry 16 deck spans, varying from 72 ft. to 84 ft. in length. These spans are followed by an earth fill between masonry retaining walls, extending from East 161st Street to East 162d Street, a distance of 475 ft.

The abutment and the 15 piers of the Jerome Avenue approach have pile foundations, capped with 12 x 12 sticks, forming a platform on which the footing courses rest. This work is to be done inside of sheet piling coffer dams. Two of the piers are skewed to allow the New York Central & Hudson River Railroad tracks to pass. All these piers are of a very usual type, and have no special interest, the variations from usual practice being all in Piers I., II. and III., the piers for the draw span. The numbering of the piers starts from the Manhattan Island pier at the bulkhead line.

The pivot pier (No. II.) is circular in plan, 47 ft. in diameter at the necking course under the coping. The coping is heavily molded and flares out to a diameter of 50 ft. 6 in. Below the necking course the shaft has a straight batter of 1 in. per foot to the footing courses. These are 51 ft. in diameter and rest on a concrete base 60 ft. in diameter. The height from the concrete base to top of coping is 19 ft. 6 in.

The concrete base is enclosed by a steel shell 29 ft. deep. This forms the outer wall of a pneumatic caisson and coffer-dam, which is of unusual design and dimensions. The lower edge of the outer wall is reinforced by plates inside and out to form a bearing or "cutting

edge." An inner conical wall joining this cutting edge with the roof of the working chamber, forms the inner wall of the caisson and working chamber. These walls are connected at intervals by brackets and the annular space between the two walls is to be filled with concrete carefully rammed in place before sinking is commenced.

The roof plates are carried by a system of 13 cross girders running parallel to each other, completely across the cylinder. These girders are all 5 ft. deep, but vary as to cross section and spacing. Between and above the girders concrete is to be rammed as sinking progresses. Above the roof level the outer wall is in three sections of varying thicknesses. The two uppermost sections coming above the level of the concrete filling, are detachable and stiffened by horizontal rings of deck beams and vertical angles so as to form a coffer dam.

Borings at the site of this pier show depths to rock varying from 18 ft. to 26 ft. below mean high water, to which latter depth it is proposed to sink the cutting edge. As there is little material overlying the rock, the bulk of the work under pressure will be in preparing the surface of the rock. This is known to be very uneven with strata set on end.

The design for Piers I. and III. is peculiar, the central part of each pier being pierced by a large archway, the axis of which is parallel with the centre line of the bridge. Under this archway are masonry steps leading down to low water, forming a boat landing. In plan, the ends of the piers are enlarged so that the general effect is of two piers united by a wall having an arched passageway through it. This arrangement is very effective architecturally and is a feature of the design. The effect of the two piers is heightened by their being surmounted by masonry watch houses.

For Pier I. it was at first intended to sink two pneumatic caissons close together, the masonry to be connected over the interval (which would come under the arch opening) by corbelling out below low water. It is probable, however, that a single caisson will be used, the outside dimensions of which will be 19 ft. x 100 ft. 1 in. As with Pier II., this is to be sunk to rock, but the borings indicate that the rock is overlain with rip rap and debris, part of which may be removed by dredging. Here, too, the rock is uneven, and considerable blasting will be necessary to bring the cutting edge to its proper level 30 ft. below high water.

The Caisson for Pier I. is to be of steel with a steel roof for the working chamber, carried by 20 in. I-beams spaced 4 ft. c. to c. The sidewalls are of steel with open L iron brackets under each I-beam, bracing the sidewalls and transmitting the load to the cutting edge. Between the brackets on the sidewalls are horizontal lines of Z bar stiffeners. On the inner faces of the brackets a double thickness of 3-in. plank is to be bolted, forming the wall of the working chamber. The space between this plank and the outer wall is to be filled with concrete before sinking is commenced. The bottom of the outer wall is reinforced by plates inside and out forming the cutting edge, and a 6 in. x 6 in. x 1/4 in. L is run around at the lower corner of the brackets. To this L iron a timber 12 in. x 12 in. section can be bolted in case it is considered desirable to increase the bearing surface of the cutting edge.

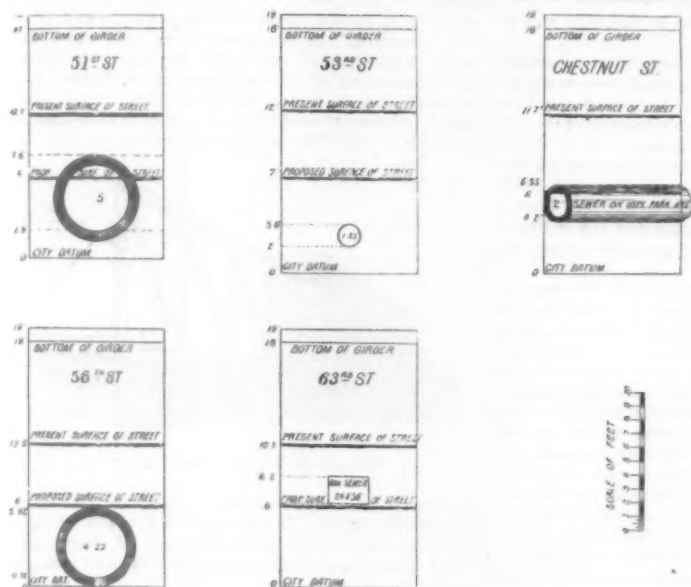
The upper section of the caisson or the cofferdam above the deck beams, is to be of timber arranged so that it can be detached after the masonry is above high-water. It is held in position by holding-down bolts every 4 ft., the lower ends of which have a connection rivetted to the outer wall of the caisson proper.

Pier III. is in the swampy land now laid bare at low tide. The rock underneath is from 21 to 37 ft. below high-water level, the overlying material being mud. It is proposed to put this foundation in by using a coffer-dam of 10 in. x 12 in. timbers splined and driven as sheet piling, and braced on the inside. If this can be done satisfactorily it will be a most important example of the use of the sheet piling method. But the difficulties in the way of making tight work by this method at such depths are so great that it seems probable some variation will be made in the plan. Owing to the great difference in level of the rock at this pier it would seem feasible to build the shallower half of the pier by the sheet piling method after the deeper half had been put in by the pneumatic method.

Raising Illinois Central Tracks at Jackson Park.

On May 23 the Chicago City Council passed an ordinance providing for the elevation of the Illinois Central Railroad tracks between the north line of Fifty-fifth Street and the south line of Sixty-seventh Street, the line being graded so as to reach the present level at Forty-seventh Street on the north and Seventy-first Street on the south. It provides among other things that the road-bed shall be raised to not less than 18 ft. above city datum at Fifty-first Street, and 19 ft. at Fifty-third Street, and that the elevation is to be maintained as far south as Sixty-seventh Street. It is provided that no part of the superstructure at street crossings shall be less than 18 ft. above city datum.

All openings are to be the full width of the street and the driveways are to be 60 per cent. of the width of the entire opening. The abutments may be set back from the street line to provide room for the use of the railroad company at its option. The supports between abutments for all long spans will be iron or steel posts placed on the curb line. All abutments are to be of stone



Proposed Elevation of Illinois Central Tracks in Chicago.

or brick. At Sixty-second street there will be a masonry arch for a pedestrian subway, 10 ft. high by 10 ft. wide. The work must be done at the expense of the railroad company, including sewer connections, changes in water pipes, sidewalks and other street improvements. The railroad company also must settle all claims for damages to abutting property. Provision is made for suitable connections with the Oakwoods Cemetery branch and the South Chicago branch. All work is to be done under plans and specifications approved by the Commissioner of Public Works. The ordinance will take effect upon its acceptance by the road, provided that the acceptance is made within 30 days.

The Illinois Supreme Court has recently handed down a decision on the four cases of the Illinois Central Railroad vs. the city of Chicago, relative to the rights of the city to open streets across the right of way of the railroad. Three of the suits were filed in the Circuit Court by the railroad company to enjoin certain condemnation proceedings begun by the city, and the court sustained the decree of Judge Tuley, which dissolved the injunction and dismissed the bill. In rendering the decision, Chief Justice Magruder says the material questions at issue have been settled by recent decisions of the court in the case of the Chicago & Northwestern and other corporations. The railroad holds its right of way subject to the right of the public, but the effect of the judgment of condemnation does not give the whole right of the land to the public, as the use of the land by the public is subordinate to that of the railroad company, trains having the prior right at a crossing. The court cannot substitute its judgment for the judgment of the City Council as is asked for by the railroad company.

This decision confirms a former decision of Judges Tuley, Collins and Horton, which held that the question as to when this power of the city as to the opening or extension of its streets across the railroad tracks is to be exercised, and as to the mode or manner in which the extension or crossing is to be made, are legislative questions, political in their nature, the determination of which must necessarily rest with the legislature, or in this case with the City Council. . . . It is for the City Council to decide what the public interests require, and it is in no sense a judicial question. It is for that body to determine whether the public interests require the crossing to be over, under, or at the surface or grade of the railroads. . . . The exercise of their franchises by railroad corporations must yield to the public exigencies and the safety of the community. Where a street crossing of a railroad has, by reason of the growth of the city and the consequent increase of railroad traffic, become unsafe to life and property, the municipality may compel the railroad at its own expense to provide a safe and sufficient street crossing by building a viaduct over its tracks.

It will be seen that this practically establishes the right of the city to compel the Illinois Central to elevate its tracks as called for by the ordinance above noted. Should the Illinois Central accept the ordinance and elevate its tracks before the Fair opens, it will receive material assistance from the Exposition company and the South Side cable road. The Exposition company has offered the Illinois Central a sum of money equal to the cost of viaducts which would be necessary if the tracks were not raised. The street car company's contribution to the Illinois Central is said to be \$100,000, provisional on the work being done at once.

To show the difficulties incident to raising the Illinois Central tracks as proposed we print five diagrams showing how the depression of the streets at the various crossings would interfere with the sewers. The cuts explain themselves. It will be seen that in three cases the proposed surface line of streets interferes with the sewers already in. At Chestnut street there is no sewer crossing the railroad, but the one on Hyde Park

avenue is parallel to the railroad and would not drain Chestnut street if that street were depressed. At Sixty-third street there is a box sewer and the depression of the street at that point would be below the sewer altogether.

These cuts show that the original ordinance for the elevation of the track was carelessly made, without due regard for the city's interest. The ordinance even in its revised form seems to be loosely drawn, though it appears that it fixes the elevation of the girders about one foot higher than appears from our diagrams; so that in each cut the figures shown at the top should appear at the bottom of the girders. Some of the streets are to have only 11 ft. headway, so that the "proposed surface" in the cuts should be: Fifty-first street, 7 ft. above datum; Fifty-third street, 8 ft.; Chestnut street, 7 ft.; Fifty-sixth street, 7 ft.; Sixty-third street 6½ ft. The first, third and last of these streets are still left in unsatisfactory shape, it will be seen.

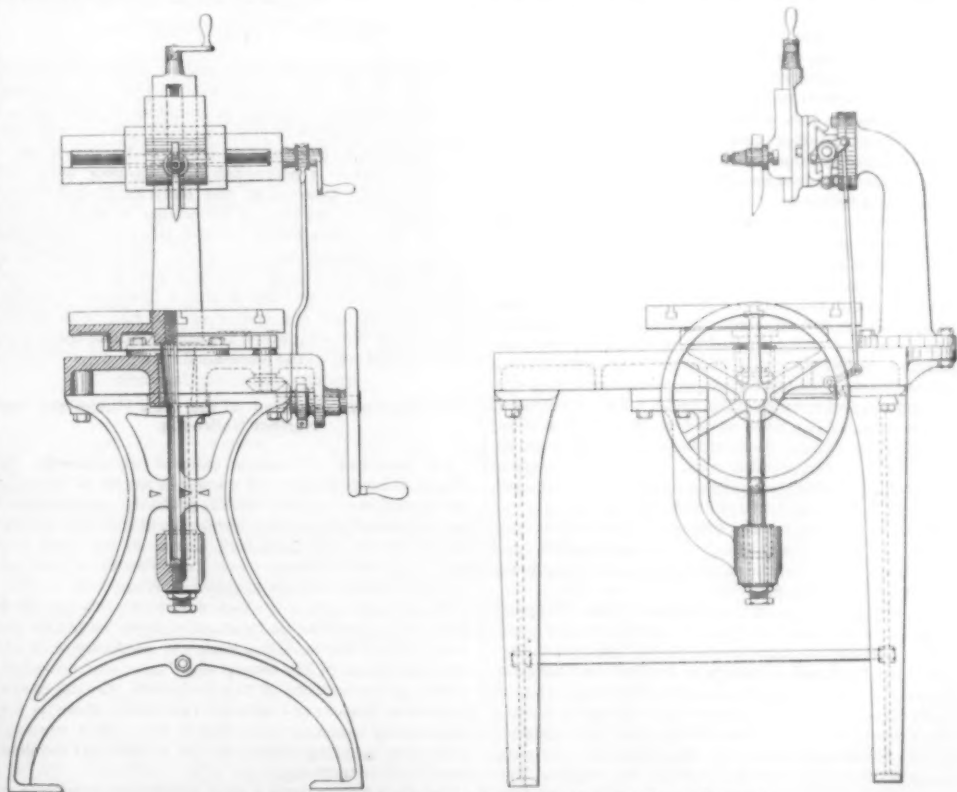
A Rod-Brass Jointing Machine.

The accompanying illustrations show front and side views of a machine for re jointing and refitting the rod brasses of locomotives, and for other similar purposes. It is built and used at the shops of the Burlington & Missouri River Railroad in Plattsmouth, Neb.

With high speed trains, it is essential that the wearing parts of the locomotive rods should be kept in the best condition, with as little delay in the roundhouse as possible. When the brasses are fitted by hand, it takes a first-class machinist some time to effect a reliable fit. Unless the fit is good, heating is almost sure to follow, and the strap will give out as well as the brass, necessitating the replacing of both at considerable cost.

The machine illustrated is constructed for the special purposes of refitting these brasses. The brass is bolted to the face plate on its back, and by a circular cut the joints are faced off true to the original planing without delay. Filling pieces to take up side motion are then sweated on and the whole faced off to a proper width and fit.

As seen, the machine is simple in construction and operation, having its face-plate resting on and revolving in a step and vertical bearing. Teeth are cast to the bottom of the plate, and by means of a small spur wheel, a pair of bevels or mitres, and a hand wheel or pulley, its revolution is effected. The cutting tool is placed above and is capable of adjustment in a vertical or horizontal direction. The machine can be used for various kinds of small work, the facing of valves, etc.



Rod Brass Jointing Machine—Burlington & Missouri River Railroad.

The Opening of the "Alley" Elevated Road in Chicago.

On Friday of last week the Alley Elevated Railroad in Chicago ran its first passenger train, carrying a party of guests consisting of prominent citizens, members of the City Council, officers of the road, etc. The train of six cars started from Congress street and ran to Thirty-ninth street, a distance of four miles, in 10 minutes. There were about 300 persons on board. At Thirty-ninth street they examined the structure, and took on a lunch car from which a lunch was served on the return trip. Coming back all of the stops were made and the guests were given time to examine the stations. The trip was a perfect success. Everything worked satisfactorily and all were well pleased with the action of the train and locomotives. This week the trains are being run on exact schedule time, but without passengers, to break in the gatemen and engineers. Next week, commencing June 6, the road will be open for regular service.

We have before described the cars, locomotives and structure. The structure and stations were given in the *Railroad Gazette* April 4 and 11, 1890. The locomotives were described in the *Railroad Gazette* March 13 and April 15, 1892. The locomotives were built by the Baldwin Locomotive Works. They are compounded on the Vaucain system and weigh 29 tons fully loaded, with 40,000 lbs. on the drivers. The boilers are unusually large and have a firebox suitable for anthracite coal, coke or anthracite slack. The cars were built by Jackson & Sharp, of Wilmington, Del., and in general arrangement are much like those of the Manhattan elevated, being finished with mahogany inside, with cane seats, etc. The doors are double and arranged so that when one-half is opened the other is opened at the same time, and by pulling one handle only, the two halves of the door being connected by wire ropes running over pulleys. The platforms of the cars are about a foot wider than those used in New York. The cars are lighted with Pintsch gas, and equipped with the Westinghouse automatic air brake. The value of this brake for elevated service was shown on a trial trip made. The brake releases instantly, and applies with the "service" or "emergency" application, as desired. It is automatic, and in case a train breaks in two while mounting the two per cent. grade going in and out of the World's Fair grounds above the Illinois Central tracks, both portions of the train will be automatically stopped. There are many improvements on the "Alley" road that are not to be seen on the New York Elevated. The stations are arranged conveniently, with the waiting rooms on the ground floor, and long covered platforms above on the structure. The road will be equipped with automatic block signals and railings for the platforms on the side next the track as well as on the other side and ends.

Four years have been required to complete this road; the ordinance authorizing its construction was passed by the City Council March 22, 1888. Since that time the entire right of way has been secured and the road completed to Fortieth street. The road runs through some of the most valuable property in Chicago. This is the first city railroad in Chicago, either elevated or surface, that had to purchase its own right of way. Much of it was secured by private purchase and a good deal through condemnation proceedings in the courts.

The successful completion of the road is due very greatly to the personal efforts and determination of its late President, Mr. Calvin S. Goddard, who has been connected with the road since its inception. His death was probably hastened by the long continued strain in promoting the interests of the road.

The road is standard gauge, double track, throughout its entire length, with the necessary side tracks and switches. The rails are steel, weighing 90 lbs. to the yard, of the Reading and Manhattan section. Van Buren street was to have been the northern terminus of the road, but owing to the impossibility of securing a right of way through the alley from Congress to Van Buren it has not been possible to carry out the original intention, and for the present the northern terminus is at Congress street. Beginning in the alley at Congress between Wabash avenue and State street, the road runs directly south till Fortieth is reached. From Congress street to Twelfth street the entire alleyway is covered by the structure; south from Twelfth street, ground adjoining the alley has been purchased. At Fortieth street the road turns to the east and runs along that street beside the Baltimore & Ohio tracks until the alley between Calumet and Prairie avenues is reached, where it again turns south. It is practically completed as far south as Fortieth street, and it is at this point that the rolling stock is taken upon the structure. A coaling station and water tower have been constructed there for temporary use.

While for the present passengers will not be carried beyond Thirty-ninth street, work south of this point is being pushed and Jackson Park will be reached before the opening of the World's Fair. At present the structure is going up at the rate of 20 foundations a day, and before the end of the year passengers will probably be carried as far south as Forty-seventh street. Elevated yards and repair shops are to be erected between Sixty-first and Sixty-third streets. Ground for this purpose has already been secured.

The American Society of Mechanical Engineers.

The twenty-fifth meeting of the American Society of Mechanical Engineers was held in the city of San Francisco, Cal., from the 16th to the 19th ult., inclusive. This convention, involving as it did a round trip across the continent, was made an occasion of most enjoyable interest, offering opportunities for social intercourse and better acquaintanceship not usually obtained in this Society's gatherings.

The party left New York at 9:30 a. m. on the 4th ult. in a special vestibuled train over the West Shore road. The details and management of the traveling arrangements throughout were in charge of Messrs. Raymond & Whitcomb, and they were admirably attended to without even suggestion of cause for complaint.

A detention of 16 hours at Chicago through washouts was taken advantage of by Messrs. Fraser and Chalmers to make a theatre party, which was thoroughly enjoyed.

On arrival at the Palace Hotel, San Francisco, the Society was received by Mayor Geo. H. Sanderson, assisted by H. W. Harkness, President of the Academy of Sciences; J. C. Stump, President of the Mechanics' Institute, and John Richards, President of the Technical Society.

Numerous papers were presented at this meeting, of which those of most probable interest to our readers have been published by us already.

At Sacramento, on invitation of Mr. H. J. Small, Supt. Motive Power and Machinery of the Southern Pacific System, a visit to the company's very extensive and complete shops was made. This is a vast plant of its kind, employing over 2,000 hands. The neat and tastefully arranged grounds, with their lawns and rich shade trees, make the works an attractive spot, and if there is anything in better work being done under cheerful surroundings, Mr. Small ought to receive a maximum manual efficiency with a minimum exertion of discipline. The company has here its own rolling mill. It makes its own fishplates and spikes and even its signal lanterns.

Through the courtesy of Mr. Small the writer was permitted to personally note the operations of different engines of the company, including the Stevens valve gear and the compounds built by the Schenectady Locomotive Works. The latter are easy steamers, good riding engines, and are operating under a fuel economy of 18 per cent. They have cylinders 20 and 29 x 24 in.; drivers, 60 in. diam.; 4-in. exhaust nozzle, and weigh, exclusive of tender, about 65 tons. In its effectiveness in preventing smoking the arrangement in use on the Southern Pacific system is worthy of imitation. It is simply an auxiliary door on the main firedoor, somewhat suggestive of the "eye of the needle." It opens outwardly, and is left open while the throttle is, the main door being provided with an air deflector.

Another device used on these engines is one more proof of the adaptation of surrounding circumstances to useful effect. It is the invention of one of the locomotive runners of the road, and is known as the Sweeney Air Compressor. It is an arrangement more of principle than of detail, consisting merely of throwing the valve motion into reverse gear, one or two notches, and conveying the air thus compressed by one of the cylinders, the right one, into the usual brake reservoir on the engine. This is an especially valuable addition to an engine on long heavy grades, where some means of rapidly restoring

the reserve pressure is an essential in the safe and expeditious control of trains.

Of course in a journey of this length some startling specimens of roadbed and varying conditions and types of motive power, were noticeable. In the side trip from Salida, Colo., to Marshall Pass, the ridge pole of the continent, 10,852 ft. elevation, a narrow gauge, 36 in. road is gone over. The locomotive used was of the consolidation pattern, with 36-in. drivers. The maximum grade is 211 per mile and the run from Salida to Marshall Pass is about 25 miles. The roadbed is good and the riding of the engine as easy as that of any standard gauge locomotive in good order.

In the design of some locomotive cabs it seems as though one of the main points kept in view was an allowance of the minimum amount of comfort to those whose duties require them to be in them. A glaring instance of this was seen recently on a Wooten engine near Wilkes-Barre, Pa. The brake piping was arranged with such seemingly studied inconvenience, that when the handle of the engineer's valve was thrown to the emergency position, it blocked, by fully one-half, the already limited space for egress from the cab in case of hurried necessity. By actual measurement the distance from the end of the valve handle to the side of the cab was less than seven inches! This same engine, by the way, showed another proof of carelessness in having its cab built too high and wide to pass through a tunnel on its own road. In pleasing contrast to these were some engines noticed along the way, notably on the West Shore road, where a cab 9 ft. 6 in. long by 9 ft. 4 in. wide was ridden in.

For having had the opportunity to make nearly all of the daylight portion of the trip on the different locomotives used the writer is indebted to the consideration of many officers, whom he thanks, but whose reluctance to get into print he respects.

Piston Rod Remover.

Figs. 1 and 2 show the details of Teal's piston rod remover, patented by S. A. Teal, Master Mechanic of the Fremont, Elkhorn & Missouri Valley Railroad. The

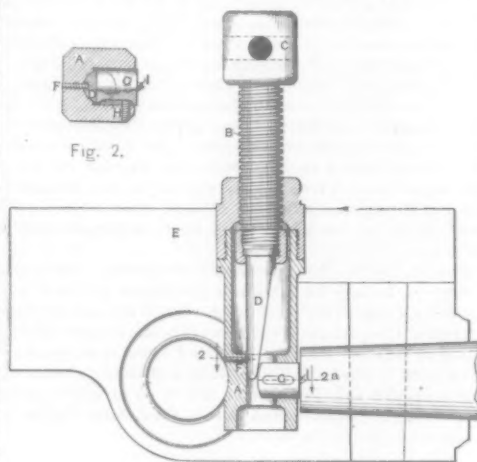


Fig. 1—Teal's Piston Rod Remover.

necessity for a powerful and compact tool of this kind is often felt in all shops where locomotives are repaired. The cuts show the remover in position in a cross head having the wrist pin in place, to press out a piston rod. The jack screw B C has attached at its lower end a wedge D, which is prevented from turning with the screw by a pin inserted in the body at F, and fitting into a groove at the back of the wedge, as shown in fig. 2. The body of the tool is made in two parts, the upper or cap nut carrying the jack screw. The lower half A is cut out at the back to fit the wrist pin as shown, and carries a plunger G. Figs. 1 and 2 having a centering point I to fit into the center of the rod. The tool is operated by screwing down the screw B until the piston rod is forced out of the cross-head.

The Woodlawn Junction of the New Haven and the Harlem Railroads.

The tendency of modern railroad management to eliminate every element of danger or source of delay in the operation of express lines is probably nowhere better illustrated than in the improvement now about completed by the New York, New Haven & Hartford and the New York & Harlem (New York Central & Hudson River) railroads at their junction at Woodlawn, N. Y.

The arrangement of the Grand Central Station, New York, with its ticket offices and waiting rooms on the west side of the building, makes it necessary that all outgoing trains (north bound) shall take the left-hand tracks in passing out of the trainshed. Owing to the congested passenger traffic at this point there is no opportunity to change from left to right-hand running until each road terminating at the station has reached its respective territory.

The New Haven trains have made this crossover at Woodlawn, for several years past, by an arrangement

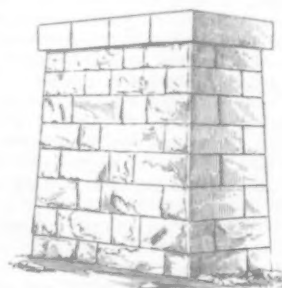
of tracks as shown in dotted lines at the point marked "Old Junction," on the plan. (The new westbound track is omitted at this point, to avoid confusion.) An examination of this arrangement will show that all eastbound trains of the New Haven road must cross its own westbound track, as well as the southbound track of the New York & Harlem at this point, and the



Woodlawn Bridge—Constructing.

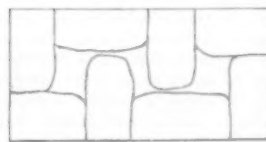
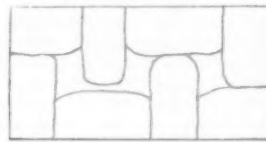
resulting delays were a constant source of inconvenience and possible danger. It was merely a question of time, therefore, when the increasing business of these roads would necessitate some modification of this arrangement.

By the new arrangement of tracks the eastbound trains of the New Haven road turn to the left (instead of to the right, as formerly), ascend a grade of 34 ft. per mile, around a three degree curve, until the bridge is reached.



A Pier of Woodlawn Bridge.

Even Courses.



Odd Courses.

Arrangement of Courses—Woodlawn Bridge.

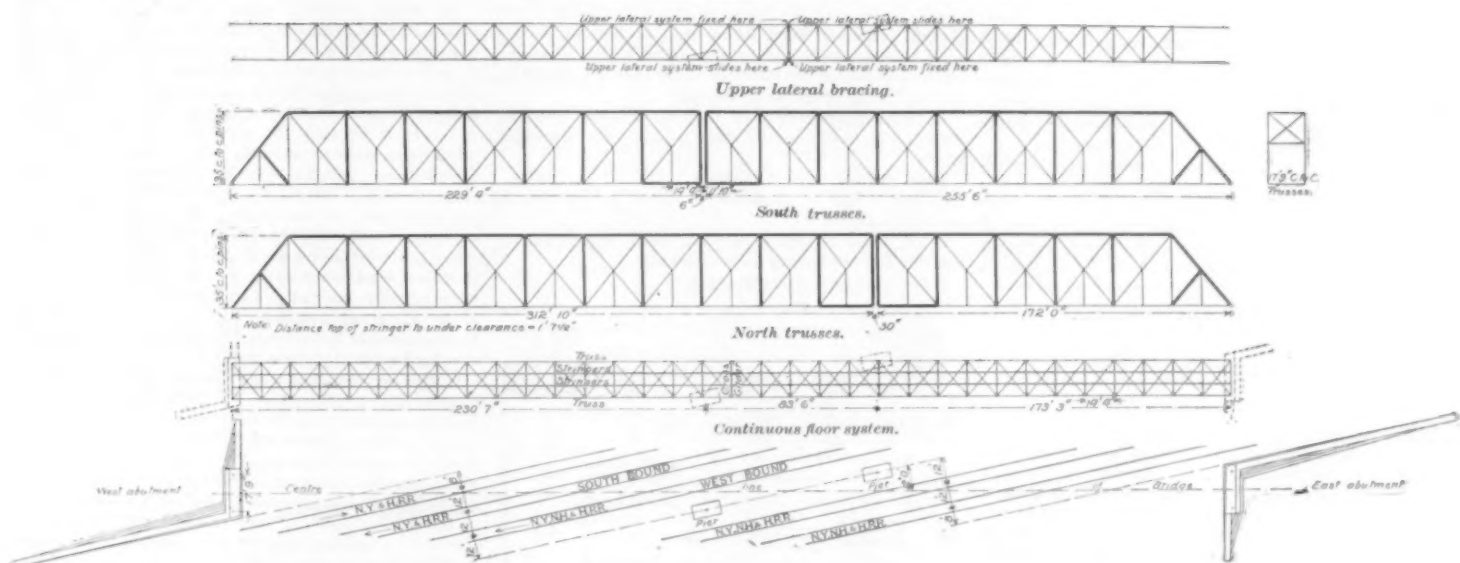
The westbound tracks are depressed at this point until the grades are 17 ft. 9 in. apart, allowing a clearance under the bridge of 15 ft. 3 in. After crossing the bridge the eastbound track curves to the left and regains its old location at under bridge No. 1. The westbound track of the New Haven road descends from bridge No. 1 at the rate of 60 ft. per mile, until it reaches the crossing, when it again ascends until it reaches the grade of the eastbound track at the Bronx River. The grades of the Harlem are similarly modified at the crossing.

In the prosecution of this work it has been necessary to make provision for the constant traffic of the two roads, with the least inconvenience to the work in



Woodlawn Bridge—Constructing.

progress. The tracks of the Harlem road were first depressed at the overhead crossing sufficiently to permit the erection of the bridge. At the same time the west abutment and the adjacent fill were constructed. The first step of the New Haven was to depress its westbound track, and in doing so it was found necessary, on



WOODLAWN BRIDGE—NEW YORK, NEW HAVEN & HARTFORD AND HARLEM RAILROADS.

account of the limited width of embankment, to use a temporary slope of 1 to 1, beginning at 3 ft. from the rail of the track in its old position.

When the track was about to be changed, however, an injunction prevented, and it was run in this temporary condition for several months, including the winter. The bank was in some places 9 ft. high, and composed in spots of fine dry sand, but where the distance of 3 ft. was adhered to, there was no tendency to slide until the frost came out of the ground in the following spring, when several cracks appeared along the ends of the ties. At several places, however, where the top of bank was closer to the rail than the prescribed 3 ft., the bank required some attention.

After lowering the westbound track to its new position, it was the intention to similarly lower the eastbound beside it. This would have taken both of the New Haven tracks out of the way during the further construction of the work, but as winter approached, and with a prospect of an up grade of 60 ft. per mile with heavy passenger traffic, the plan of depressing the eastbound track was abandoned, and it was run south of the east abutment until the bridge was completed. The fill was completed on either side of the temporary location, and when the final change over the bridge was made, this opening was closed between trains.

The bridge which spans the depressed tracks is a structure of two spans, with square abutments at each end, and two intermediate piers ranged in the line of the depressed tracks. The original plans of the improvement provided for a single skew span over three tracks, but it was later considered advisable to lay new tracks on the old location of the New Haven tracks, and consequently the easterly span was added by that company. The abutments were finally squared, and the middle of the long pier omitted, making two smaller ones as indicated in the plan.

The abutments are of broken range, rubble masonry, and the piers of regular coursed ashlar work. All bridge seats are of Pine Island granite 2 ft. thick and the ashlar work of Yonkers gneiss.

The bonding of the piers is unusually thorough, as will be seen in the accompanying photograph of the east pier, which carries the long truss. The headers, in every instance, extend to within 6 in. of the stretcher on the far side of the wall, and they are so arranged as to have

thorough bond, in adjacent courses, as well as with adjacent stones of the same course. While this bond is always sought in this class of work, it is rarely seen so

between piers. The bridge is fixed at the west abutment with rollers at all other pedestals, provision for expansion of rails being made at the east end by the use of trailing switch rails. The truss used is the subdivided Pratt type, usually adopted now for long spans, instead of using multiple systems. The floor beams were suspended by plate hangers, and the ends were rigidly connected by a longitudinal, acting to steady the beam, and serving to transfer the increment of strain from the lower lateral system into the lower chord of the trusses.

To provide for a minimum depth of floor, short panel lengths were used, and the stringers were connected to the webs of the floor beams and resting upon their bottom flange angles.

The continual passage of trains beneath the bridge during erection, with the limited clearance under the floor beams prevented the use of any falseworks, lower than the bottom flange plate. In erection, therefore, the caps of the falseworks at each main panel point were placed on each side of the floor beam, and the beam itself carried on 4-in. pieces, between the cap and post of the falseworks. The intermediate beams were omitted until after the trusses were swung.

The arrangement of the falseworks on each side of the floor beams prevented the completion of the floor system until the span was swung and false works were removed. The trusses of the west span were first erected, complete, with the top lateral bracing, as far as the west pier. The remaining length of the long truss—to the east pier—was also erected, but that portion between the piers (86 ft. long) could not be connected to the opposite truss by the top laterals until the east span was also in place. As the timber of the falseworks of the west span was to be used in the erection of the east, that portion of the top chord of the long truss which was unbraced was stayed by wire guy lines; the portal bracing over the west pier and abutment was firmly connected, and the top laterals carefully adjusted, and the span was then swung, the top lateral system holding it in position. The falseworks were then removed, and the floor systems and lower laterals completed to the west pier, after which the east span was erected and the bridge completed. It was put in service May 15.



Woodlawn Bridge.

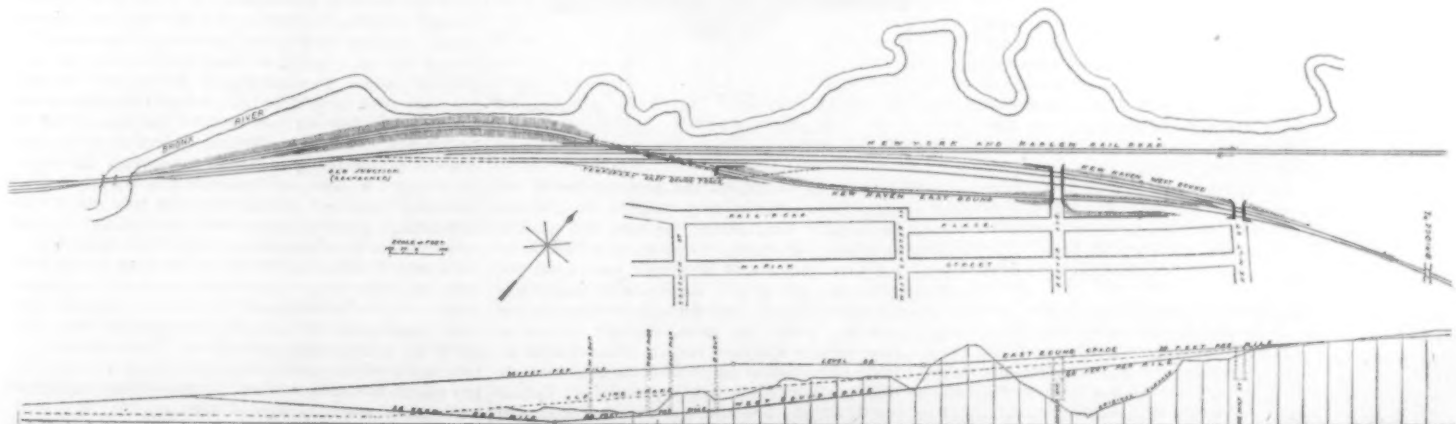
Track work and banks not finished.

perfect as here shown. The foundation of the pier is gravel, and sustains a pressure of 6,000 lbs. per sq. ft.

The superstructure is of wrought iron and steel, the eyebars and pins only of the latter material. By changing the abutments from skew to square, the action of forces in the superstructure was much simplified, and the amount of masonry saved was about equivalent to the extra cost of the iron work. Any additional expense that might be incurred was sustained by the New York, New Haven & Hartford.

The iron work is designed to give the appearance of a continuous truss for the entire length, but a double post over the piers simplifies the strains. The floor system is continuous from end to end of the bridge, the panel length being so arranged as to conform to the distance

maining length of the long truss—to the east pier—was also erected, but that portion between the piers (86 ft. long) could not be connected to the opposite truss by the top laterals until the east span was also in place. As the timber of the falseworks of the west span was to be used in the erection of the east, that portion of the top chord of the long truss which was unbraced was stayed by wire guy lines; the portal bracing over the west pier and abutment was firmly connected, and the top laterals carefully adjusted, and the span was then swung, the top lateral system holding it in position. The falseworks were then removed, and the floor systems and lower laterals completed to the west pier, after which the east span was erected and the bridge completed. It was put in service May 15.



The expense of the improvement is borne about equally by the two roads benefited, but in order to avoid any annoyance during construction it was mutually agreed that each road would construct that portion upon its own property, and in addition to this the New Haven Co. constructed the piers and that portion of the superstructure which came over the Harlem property.

The contractors for grading and masonry were Clark & Westbrook, and those for the bridge superstructure and erection were Post & McCord, all of New York. The work was planned and constructed under the supervision of Mr. F. S. Curtis and Mr. Walter Katté, Chief Engineers of the N. Y., N. H. & H. R. R. and of the N. Y. C. & H. R. R. respectively. For the facts here given we are indebted to Mr. H. B. Seaman, Resident Engineer of Construction, N. Y., N. H. & H. R. R.

Draft Gears for Freight Cars.*

BY D. L. BARNES.

The reliability of the connection between the cars of railroad trains should be of interest to all who are connected with railroads in any capacity, as upon it depends the safety and the rapid movement of passengers and freight. Weak draft gears and couplings frequently cause delays and wrecks, which give trouble in all departments, and in some instances have materially increased the extent of a car famine, and in various ways, directly or indirectly, an inadequate connection between the cars of a train causes much annoyance to both shippers and carriers. Reliable information obtained from the headquarters of some of our largest railroad lines shows that often from 60 to 70 per cent. of all the cars standing idle for repairs have been taken out of service because of defects in some portion of the draft gear—either couplers, sills, draft springs or attachments. This is reason enough for the statement that either not enough attention is now given to the construction of the types of draft rigging commonly used, or a strictly new type is needed.

The variation in design and dimensions of the present forms of draft gear is to be regretted, as it increases the repair account and delays repairs. The number of pieces per car varies from 60 to 300, and the weights from 200 to 1,250 lbs. One type of gear has 234 pieces of forgings, 62 pieces of castings and 6 pieces of timber per car.

Perhaps it is not the weakness of what is more strictly speaking the draft gear that causes a majority of the failures in service; it may be that the cause lies in the sills, as it is noticeable from an examination of cars on repair tracks that the timber of both the draft and centre sills taken out is fractured and broken, yet it is generally of a better quality than when first put in. It is, in fact, a high class of seasoned lumber, such as cannot be purchased in the open market. The timber which is put in place of that taken out is not of as good quality as that which is removed: hence the process of repairs is a substitution of unbroken green timber for fractured seasoned timber. Does not this indicate that either we are not using a size of timber large enough to withstand the shocks, or that the timber is badly placed to resist the strains that are imposed upon it? This is a question which should be answered before a standard car or draft gear is selected.

On account of the varieties of designs and the failures in service, the indications are that the Master Car Builders' Association will soon be compelled to consider some means for the improvement of the draft gear of freight cars. It is noticeable from the records of the Association that it has investigated the construction of parts of cars whenever the results of service have shown them to cause an unusual amount of annoyance. Annoyance may result from weakness of parts or great variety of designs and dimensions. A vast array of new designs usually follow a display of defects. This is, of course, desirable, as it leads to improvements in construction, but there must generally follow some steps taken by the Association to reduce the number of types in service. This reduction is most quickly brought about by the adoption of a standard design, and it is the possibility of a standard draft gear of a radically improved type to make with the vertical plane coupler a reliable connection between cars that gives to this subject so much interest.

It is impossible within the scope of a paper of this kind to describe in detail the different kinds of draft gears now in use. Only the more prominent ones can be selected, and but little can be said of each by way of description. The illustrations give in a general sort of way the method of construction followed in each, and such description as is given points out only the principal characteristics of the different designs.

The first to be considered is the form of draft gear which some years ago was almost a standard. It is given in figs. 40 and 41. It consists merely of two castings bolted to the draft sills by $\frac{3}{4}$ -in. bolts. The followers are held in position by two binders, one above and one below.

Perhaps no better illustration of the increase in the strains and blows of freight service could be offered than by calling attention to the fact that this comparatively weak and inefficient draft gear was formerly sufficiently strong to do good service. To-day it is wholly inadequate, and has but a fraction of the resisting power

*Read before the New York Railroad Club at a regular meeting, May 19, 1891.

that is possessed by some of the other designs here shown. This old form when used in present service soon becomes loose and by a wedging action produced by the bending of the follower plates causes a spreading and splitting of the draft timbers.

The draft gears now used may be divided into four classes with reference to their capacity for absorbing blows:

First, those of normal capacity.

Second, those of increased capacity having two or more springs.

Third, those of still greater capacity with the anti-reaction feature having friction devices.

Fourth, continuous buffing gears.

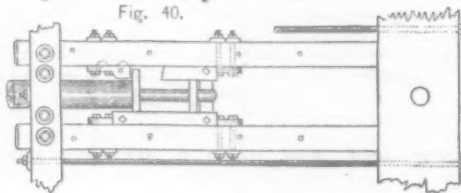
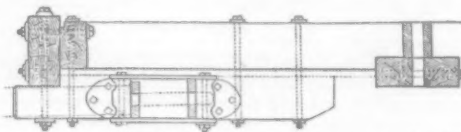


Fig. 41.

Yet this is not a satisfactory classification as it does not hold good for buffing blows when a buffer stop is used on the couplers. This is for the reason that comparatively light blows, such as are of common occurrence, will drive the buffer stops on the couplers against the end sills; therefore, the more severe blows which do the real damage must be taken by the end sills and the buffer stops, and not by the draft rigging. Hence when buffer stops are used on the couplers there is but one class of draft gear with regard to blows; viz., continuous buffing gears.

[The descriptions of different rigging we omit.—EDITOR.]

The alternative connection, shown in these illustrations, namely, the tail bolt vs. the tail strap, now demands attention, as the breakages of tail bolts are frequent and expensive. The preliminary report of the committee appointed by the Master Car Builders' Association on vertical plane couplers recommends the use of the tail bolt instead of the tail strap. The bolts break in various ways, but under the heads and through the keyways principally. Yet in a majority of all cases of broken tail bolts the cause has been bad workmanship or bad material. The bad workmanship has been permitted by lack of inspection on the part of railroad companies purchasing cars, and bad material has been permitted for the same reason. The bad workmanship shows itself in the reduction of the size of the bolts where the key-way is punched and in the bad usage which the material receives where the head is formed. In some cases the heads have been pulled off the first time the cars were hauled. Probably the tail bolt will be discarded, as it must be well made and of good material in order to be even reasonably safe. With the tail strap it is different. It is easily made without injury to the material, and owing to the greater amount of material used there is a greater margin of safety.

The use of dead blocks to receive the buffing blows is a matter of universal interest now, as with them on all cars the draft gear and couplers are supposed to be relieved from all severe blows, and this is generally true with this exception: A dead block with a vertical plane coupler is of no value when the couplers come together

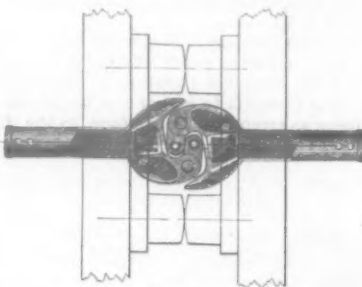


Fig. 42.

with the knuckles closed, as the compression of the draft springs is not sufficient to permit the dead blocks to come in contact. But, except for this, the general statement is true that wherever cars are fitted with dead blocks, properly placed and of proper length, all the buffing blows that are of any considerable magnitude are resisted directly by the sills without the intervention of springs of any sort. One unsatisfactory feature of action of our present standard vertical plane coupler is, that it cannot be protected under all conditions by dead blocks. This is shown more clearly perhaps by figs. 42 and 43, which indicate the position of the dead blocks on the same cars with and without the closing of the knuckles when the cars come together.

The actual practical value of dead blocks with the vertical plane coupler is a little uncertain. Of course, it depends upon the relative numbers of the blows delivered in coupling with and without the knuckles open. Probably as long as there are conditions, such as shown in fig. 43, under which the coupler must withstand the whole blow without the assistance of dead blocks, it will be necessary to make the coupler with a buffer stop of sufficient capacity to resist the severest shocks. When this is done, it remains a question whether dead blocks are necessary. In considering this subject, the many varieties of collisions of vertical plane and link couplers are omitted for the reason that it is evidently impossible to make dead blocks that will be suitable for vertical plane couplers and link and pin couplers at the same time. What is now being examined into is a draft rigging and arrangement of buffers suitable for future use with our standard vertical plane coupler.

It then appears that when couplers are provided with a buffer stop, all couplers should be, that buffer should form the protection to the draft rigging. We have seen that in ordinary service the buffer stop on the coupler is nearly always forced against the end sill, and however strong the draft gear may be, or however weak, it cannot offer assistance in resisting blows until the buffer stop on the coupler is driven into the end sill. Where the end sills are properly protected by angle irons or plates, as shown in several of the illustrations, cars will run many miles before the buffer stops are driven into the end sills as much as $\frac{1}{2}$ in. This brings up an important question. Should not the draft rigging be so devised that it would not close up to a fully closed position so as to receive a buffing blow until after the buffer stop on the coupler has been driven into the end sill at least $\frac{1}{2}$ in.? If a draft rigging were arranged in this way, and the plates on the end sills were kept up, there would be less talk about draft gears having a high resisting capacity and less damages to draft appliances, as they could only receive severe buffing blows after the buffer stop on the coupler had been broken off or driven into the iron plate on the end sill at least one-half inch.

Unfortunately, this subject has received but little attention, and cars are being built with buffer stops on the drawbars without any protection in the way of metal

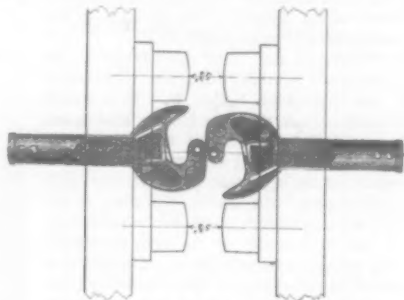


Fig. 43.

plates on the end sills, and with such dimensions that the draft rigging is closed up when the buffer stop comes against the end sill. With this bad practice the wooden end sill soon pounds away, and the entire blow is forced upon the draft spring and rigging, which soon gives way and is driven back under the car as fast as the buffer stop wears away the end sill. Evidently the way to prevent this is to have a close inspection to insure a proper placing of the draft gear and the use of metal plates on the end sills.

Those who favor high capacity draft springs and appliances for absorbing blows other than that provided for by the buffer stop will be interested in noting what it is possible to accomplish in this direction. For this reason a diagram, fig. 44, has been prepared which shows the capacity of one and two draft springs to absorb the blow delivered by a loaded 60,000-lb. freight car moving at about four miles per hour. The area of each of the two small triangles at the bottom of the diagram represents the capacity of one draft spring of ordinary dimensions to resist a blow before it is closed up. The large rectangle shows on the same scale the amount of the blow which can be delivered by a 60,000-lb. freight car moving at about four miles per hour. This is a speed at which couplings are frequently made, and at such speeds no real damage is generally done either to the car or to the draft gear. A comparison of the area of the large rectangle with the area of the two small triangles shows how much greater is the blow than the capacity of the draft springs on the two colliding cars to absorb it. This relates to the ordinary car with one spring. The capacity of gears with two springs would be represented by twice the combined area of the two triangles. With two springs per gear there would still remain a large percentage of the comparatively light blow at four miles per hour to be absorbed wholly by the draft timbers, the sills, the buffer stop or the dead blocks, according to which of these is interposed to take it. Devices have been brought out of still greater capacity than that given by two springs, such as the Westinghouse friction buffer, which is correct in theory, as it aims to actually absorb the blow without injurious reaction, such as takes place when springs of high capacity are used. The theory of the friction buffer is correct, but it remains to be seen whether a sufficient capacity can be

given to that buffer to absorb the large percentage of the shock, which is illustrated by that portion of the rectangle remaining above the combined area of the two small triangles on fig. 44.

One point remains to be considered: it is the continuous draft and continuous buffing gear. The American, as shown in figs. 38 and 39, is the one most extensively used. In buffing the blows are taken directly on the subsill, which is protected by metal for the purpose, and in pulling the strains are taken by the draft sills before the spring is closed. Hence, with this arrangement, the spring is relieved from the blows of buffing and the shocks of uneven draft, evidently a most desirable result, and one which contrasts strongly with those constructions which permit the blows to be received by the draft springs after they are closed up. A continuous draft gear is also the result of using a steel centre sill, as shown by figs. 23, 24 and 25 of the Harvey type, and figs. 36 and 37 of the Westinghouse. In these designs the steel centre sills provide a continuous drawbar and a continuous buffer with a minimum number of parts.



Fig. 44.

There are some designs, such as the Lake Shore, figs. 28, 29, 30 and 31, which are, in fact, continuous buffers—that is, the buffing blows are transmitted from end to end of the car by means of a sub-sill, which is provided below the centre sill. A sub-sill is now common. The result of its use is the strengthening of the draft attachment and an increase in the weight and cost of the car. It is not of great value where a proper buffer stop is provided on the coupler, for the reason that if the draft rigging is put up as it should be, the buffer stop on the coupler will transmit the blows directly to the centre sills, which are manifestly strong enough to withstand any reasonable buffing.

In closing this short review of the various types of draft rigging now used, it seems but proper to point out what will probably be the ultimate result of so much invention and multiplicity of parts. The increase in cost and weight of draft rigging will go on until the expense is somewhat greater than the cost of metal centre sills; then steel will be used, as it should be, to replace the already inadequate wood, then a continuous draft gear and a continuous buffer stop will be provided without complication in such a way as to give to freight cars a greatly increased durability. This time is near at hand, as the price of steel channels is now about \$40 per ton, and it is considerably cheaper to put steel centre sills in freight cars than to meet the expense of some of the stronger and more desirable types of draft gear for wooden sills now used. However, it is not to be understood from this that a steel centre sill will render it desirable to attach the draft rigging directly to the sills with such security as to permit that rigging to resist the buffing blows. Ultimately it is evident that the pulling strains will be taken up by the draft gear, but the buffing blows must be resisted by the buffer stop on the draw head striking against some form of wooden buffer, as wood is the cheapest practical absorbent for blows that is known in the mechanical arts.

Illinois Central Passenger Cars for World's Fair Traffic.

There have been built at the Illinois Central shops in Chicago four sample cars, such as the company proposes to use for the World's Fair business. These cars embody the several ideas and plans suggested by the machinery and operating departments. The plan is to construct a car that will be capable of being loaded and unloaded quickly, strong and light, and yet one that can be used for other service, with but slight alterations, when the Exposition closes.

The first car built was patterned after the present suburban coaches with end platforms, Miller coupler and buffers, and clear story with the usual ventilating sashes. The car is 45 ft. long, having the suburban car body and roof framing. There are 20 seats placed across the car, similar to those in the well-known open summer street cars, dividing the car into 10 compartments. The seats are placed back to back. There are the usual openings at the sides of the car, between the seats. The siding is carried up opposite the ends of the seats and has a window above the belt rail. There are no doors to these side openings, but they are closed by means of sliding bars worked automatically and in unison by means of a lever and suitable rod connections attached to the sides of the car near the end. These bars or gates are locked and unlocked automatically by a simple gravity lock, designed by one of the shop workmen. The usual curtains for rainy weather will be provided. There are also seats at the ends of the cars facing the platforms. This car will carry about 110 people. There are no steps to the car, as all trains will be run through without stops between Jackson Park and the terminal stations. The depot platforms will be raised

to the same height as the floor of the car as on the elevated roads. The trucks are of the standard four-wheel equalizer pattern.

The other three cars have heavy 35-ft. freight car bodies and freight car roofs, diamond arch bar trucks with rigid bolsters and elliptic springs. There are no end platforms, the ends being closed entirely. They have M. C. B. standard couplers, iron brakebeams and Westinghouse air brakes. These three cars differ from one another only slightly in some of the details of finish; they are arranged similarly to the one first described above, having the cross seats and side entrances and no steps. There are eight compartments and they seat about 80 passengers.

The first car of suburban type described above was deemed impracticable because it could not be converted into a standard car. Again there would be too many of them for regular suburban service after the fair and they would be too light for through traffic. The cars with freight car bodies can be converted into fruit or refrigerator cars with few alterations and slight cost and therefore they are better adapted to present and future service. The cars are painted and lettered to correspond with the standard passenger equipment and present a very good appearance. The three modified freight cars weigh about 28,000 lbs. each.

The New York Rapid Transit Commission.

The Supreme Court Rapid Transit Commission met at 1.20 p. m. on Monday, May 23.

Mr. S. P. Nash filed an appearance on behalf of the corporation of Trinity Church, and M. N. Cohen, the Counsel for the Consolidated Telephone & Electric Subway Co., stated that his clients had no feelings antagonistic to the Commissioners' plans, but merely wished to throw out a warning to the Commissioners that at every street crossing the roof of the proposed tunnel would trespass on the premises of the subway company, there being at such points manholes from 9 to 15 ft. deep, which were necessary for handling the cables in the subway.

Mr. Potter then called George H. Radford, of the firm of Vaux & Radford, the well-known architects, who stated that he had been a civil engineer for 45 years, 25 of which had been spent in this country. In England he had been an assistant in the office of Sir John Fowler during the construction of the Underground Railway, and saw the whole progress of that work, although not actually engaged in its construction. He described very clearly the difference between Broadway material and the material encountered in the construction of the London railroad, which was blue clay and compact gravel containing no water. The greater part of the construction was by excavation from the surface. In deep cuts the clay would stand vertically without much shoring. The foundations of London buildings are placed at shallow depths and are continuous walls, not isolated piers, as is the case with all the buildings on Broadway. These walls were undercut and underpinned in 4 ft. lengths opened from the surface. The witness said he had seen all the buildings erected here for many years, and he does not consider it practicable to go from 7 to 9 ft. under Broadway by means of a tunnel without the street settling. He considered it impossible to make the roof of an iron structure such as was proposed by the rapid transit plans tight and impervious to water and gas, and doesn't care who says it can be made so. From Union Square to Thirty-fourth street, where rock is found at irregular depths of 4 ft. and more below the surface, it would be practically impossible to build the tunnel without opening the surface of the street. The rock would have to be plugged and feathered to be removed, as it would not be safe to blast it, and it would be an exceedingly expensive and slow process. At Canal street the bottom of the proposed tunnel would be 10 ft. below tidewater, and the sheave-pit of the cable railroad at Houston street is so low that more than one-half mile of the tunnel would have to be built below tide level, and it would be impracticable to keep it clear of water after construction. All along Broadway he considered that it would be necessary to shore up the fronts of the buildings in order to underpin the shallow walls and piers, and to open the street at the house lines to do the work. At the stations where the platforms extend up to the house lines, he considered that the running of trains would endanger the property for business purposes very materially. In rock foundations the passage of heavy trains would cause a very serious and annoying vibration in all buildings on each side of the street, and in any material, whether sand, rock or gravel, the passage of heavy trains through the proposed tunnel would produce serious annoyance in all the buildings along the route. The ventilation of the tunnel he thought would be altogether impracticable. In the London Underground road the sectional area is 402 sq. ft. for two tracks; in the proposed tunnel it would be 484 sq. ft. for four tracks. The London tunnel is ventilated by blow-holes in the street. Here it would be impossible to put blow-holes in, and the only means of exhausting the air would be through the stations, which would produce a very strong current of air—strong enough, he thought, when four trains were approaching a station to blow people off the platforms. He considered any increase of speed over that of trains on the New York Elevated and the London Underground roads

as impracticable with the stations placed as close together as was proposed by the Commissioners. He objected to the whole scheme as not comprehensive, and independent of all existing lines, and not capable of communication with them. Travel in the confined spaces and the small cars proposed would be very objectionable, as the exhalation from the passengers would all be boxed in and there would be no possibility for the escape of the foul air. He did not think that the average man would care to travel on the road at all, if built. He objected, moreover, to the method of construction providing for four chambers divided by three rows of columns which were too close to the cars to insure safety, as a derailment of a train at high speed would break down a column and thus let down the roof. If the speed proposed by the Commissioners should be attained, the danger by derailment in transit would be greatly increased.

An unfortunate question by the counsel led the witness into the promulgation of his pet scheme for the extension of Rapid Transit, which was to rebuild the Third Avenue Elevated road from Forty-second street to the City Hall, putting in a heavier structure and more tracks so that trains from the Hudson River and the New Haven Railroads could run down direct to the City Hall. As he remarked, he would make the Bowery below Cooper Union "a track yard." He would also bring the trains of the Harlem River and Portchester roads over the bridge at Second avenue, and down to South Ferry over the Second avenue track and would make a loop at the Battery so that trains could run around from the east to the west side of the city if necessary. He thought that the work necessary for this could be done in 18 months, whereas it would take five or six years to build the road proposed by the Rapid Transit Commissioners.

His cross-examination by Mr. Bowers did not develop any new points except to set the counsel right as to his understanding of certain terms used in an unscientific popular magazine article on the "Underground Railways of London," where "tunneling" was spoken of and Mr. Radford explained that the tunnels meant were merely short stretches underneath structures which had been already underpinned by working from the surface.

Mr. Lawson N. Fuller then asked permission for the ladies of Washington Heights to be heard before the Commission through their spokesman, a lady who is tutor in Greek in the Normal College.

The Commissioners appointed Wednesday for the hearing and then adjourned until 2.30 p. m. of Tuesday, May 24, when Mr. Potter put on the stand Frederick Southatch, a real estate agent, who for 18 years has paid particular attention to the leasing of property on Broadway from the Battery to 23d street. On this portion of Broadway the renting property is equivalent to about 1,000 lots of 25 ft. frontage by 100 ft. deep, and the average rental value is \$11,000 per annum per lot. In a large proportion of the frontage, the vaults outside of the buildings and under the sidewalk are occupied by boilers and steam engines. In the majority of instances the basements along the street which are lighter from the area way outside the building, are rented independently of the first floor. In case of the construction of the proposed road, about 20 per cent. of these basements would be cut off from light by the stations, and could only be rented as dark storage rooms in connection with the store floor, and the rental value of the property would be seriously diminished. The probability of interruption of street traffic during construction of the railroad would deter tenants from making or renewing leases, with the result of lessening the value of the property, and diverting the business to other quarters and the final result of changing the entire character of the street. During this process of change rental values would be seriously deteriorated, and probably forever after in consequence of the annoyance produced by the passage of heavy trains through the tunnel.

Mr. Bowers did not make much headway in cross-examining this witness. He could not get him to assent to the proposition that the opening of the roadway would be the worst or most annoying feature of the whole business, and when with a triumphant air he read to the witness from a pamphlet furnished him by Melville C. Smith the names of several persons who occupied offices in some of Mr. Potter's buildings, and who had once petitioned for the Arcade Road, the witness simply said that he did not recognize among them a single dry goods man or occupant of ground floor property on Broadway.

Mr. Samuel Spencer was then recalled for cross examination by Mr. Potter. He said that the Commission had considered it important to make an effort to produce a system of Rapid Transit which should be independent of existing railroads, not dependent upon them for success, and therefore incapable of being throttled and defeated by them. Such a system need not be necessarily incapable of combination and absorption by any existing system. The Commission had no objection to any one or more people or parties obtaining control of the new system—they only wanted it to be the best for the people that they could devise.

He, himself, and the Commission considered travel in the air above ground to be far preferable to travel underground. He acknowledged that when they had their report under consideration the excitement of the public and the newspapers did have weight in shaping their de-

termination. They did not permit any popular outcry against any particular existing corporation to affect their course, but they did consider that under the circumstances it was their duty to provide some entirely separate system, and give the people an opportunity to see whether it could be carried out.

He had nothing to say regarding Mr. Worthen's plans of procedure or estimates of cost. They were not promulgated by the Commission, nor was anybody's method of carrying a shield through the material adopted or endorsed by the Commission, nor was it their business to do so. If any party got the franchise he could go around among tunnel builders and compare their ideas and methods and prices. The Commission could not do this. If it should prove to be necessary to open the surface for the whole length of Broadway, of course it would have to be done, but without having made a critical examination as an engineer, he thought that for a large portion of the way the structure could be built by tunneling, and that *with care and cost* the entire street could be tunneled. If it should prove necessary to open the whole street surface, the plan ought to be modified, but how he could not say now.

Mr. Potter then in his most suave and courtly manner, asked the witness, "Supposing us to be free and uninfluenced by any feeling regarding the management of the elevated railroads, would not an elevated system be preferable in every respect to an underground system?" This brought Mr. Bowers to his feet, in a fearful state of excitement and full of objections, which the Chairman promptly calmed by observing that he did not think that the witness, as a Rapid Transit Commissioner, was called upon to answer the question.

Mr. Spencer went on to say that the Commission had considered the practicability of elevated roads and all kinds of viaducts, and they had concluded to put before the public the underground scheme and go through all the required processes to find out whether they wanted it. As for himself he thought New York with its elevated roads was far ahead of London with its underground roads as regards Rapid Transit facilities.

To an inquiry from the chairman as to whether he thought capital would take hold of this scheme, the witness said he would be glad to throw light on that question, but could not and nobody could. The franchise had to be sold at auction and until people were ready to put up their money, no one would be willing to say anything about their intentions. In considering the question of capital, the Commissioners had decided to offer the underground scheme first, as being probably less costly than any viaduct scheme they had considered which was of equal efficiency.

The witness was allowed to retire, having produced by the prompt and intelligent manner in which he replied to all questions, and the breadth and fairness of the opinions he expressed a most favorable impression on all his auditors.

There being no other witness present, the irrepressible Mr. Melville C. Smith rose to express his earnest conviction that any one who opposed a subterranean road on Broadway was either a knave or a fool, or words to that effect.

On Wednesday, May 25, Mr. Fuller introduced some ladies from Washington Heights, and Miss Merington read a paper opposing underground travel. Several additional property owners filed appearances in opposition to the Commissioners' plan.

On May 26 Mr. Berkwith again appeared to explain how the proposed road would damage the subway system, and Mr. Renwick, the architect, presented his reasons for thinking that the buildings on the street would be endangered by the proposed construction.

Punching and Shearing Machine.

The illustration shows one of a series of punching and shearing presses which the E. W. Bliss Co., Ltd., Brooklyn, N. Y., are now putting on the market. It will be noticed that the design combines great strength with neatness of appearance.

The clutch can be operated either by hand or foot, and in the large sizes of punching presses the clutch sleeve is disengaged by a positive device. The presses can also be furnished with automatic clutches which, in response to a pressure on the foot treadle, cause one complete stroke with an automatic stop at the highest point. This is preferable where the operator requires a longer time for getting ready for the following stroke than intervenes between two successive strokes of a machine running continuously.

The strippers are easily adjustable for different thicknesses, and the slide can be brought down upon the work by hand for adjusting purposes by means of the lever and capstan shown. The adjustment of the slide for each is effected by means of taper gibs extending the whole length of the guides, operated by a screw on top. The foot and hand levers are independent of each other, the operation of one leaving the other at rest. Stay rods, as shown, can be inserted for extra heavy work.

Shears for slitting and cross-cutting, and tools for gang punching, can be substituted for the punch and die shown.

The machines are made in all sizes, calculated to punch from a $\frac{3}{8}$ -in. hole through $\frac{3}{8}$ -in. iron to $2\frac{1}{4}$ -in. hole through $2\frac{1}{4}$ -in. iron, and to shear bars up to $1\frac{1}{2}$ in. \times 10 in. The depth of throat varies from 6 in. to 43 in., and the weight from 1,200 lbs. to 70,000 lbs.

Electric Locomotives for Short Steam Roads.

After all, the stages of evolution by which we have attained the present point in electric railroad work have been comparatively slow. Several years ago Mr. Leo Daft built an electric locomotive work for Elevated Railway experiments in this city. The motor was of about 125 H. P., and behind it the present writer more than once made the best speed he has ever seen on the Manhattan system. In 1886, Mr. Frank J. Sprague made some very interesting experiments on the same road with trains of individual motor cars, and also began the construction of a double bogie truck car, each axle driven by a 75 H. P. motor, making a 300 H. P. equipment, and weighing, with the car and passengers, about 30 tons. In 1888, also, Messrs. Bentley & Knight and the Rhode Island Locomotive Works made plans for a 670 H. P. electric locomotive. These plans were published in Martin & Wetzler's work on the electric motor, at the time, but, we believe, were never put into execution. More lately, the City & South London underground road has been operating with electric locomotives of about 100 H. P., made up by a 50 H. P. motor driving on each axle; and a few months ago, the Thomson-Houston Co. built a locomotive of about 125 H. P. for freight service at Whitinville, Mass. That locomotive, on trial, handled a train of four to six heavily loaded cars, or an aggregate load of 200 to 300 tons, at a speed of five miles an hour on a level.

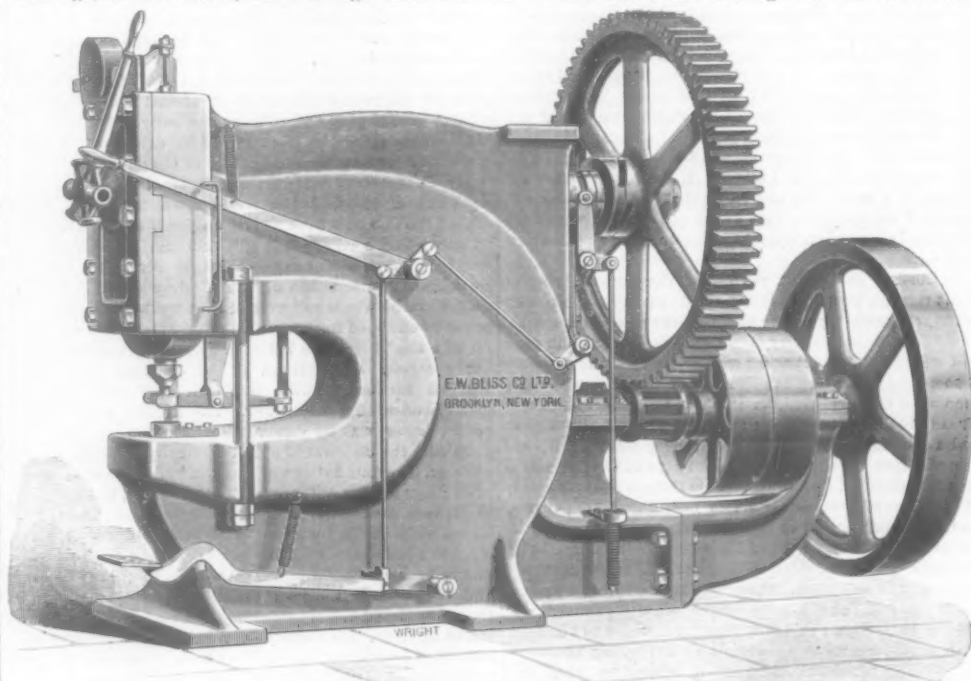
It might be said, with truth, that all this preliminary work does not touch the main issue, the practical substitution of electricity for steam on a regular steam road—but the new day has arrived, and we are glad to make note of two highly important events marking the initial steps of the change. Perhaps Mr. Henry Villard, the president of the North American Company, always a shrewd and enthusiastic believer in the possibilities of electric traction, deserves the credit for making the first contract for electric locomotives on a steam road. He has been anxious to improve the facilities around his Northern Pacific terminals in Chicago, and more than a month ago, it is understood, made an agreement with

miles of track to change. On the 40 miles between London and Exeter, where the third rail was in place, the track is laid with cross ties. On this portion no immediate change was necessary, as the third rail and the double frogs can be taken up at leisure. The remainder of the road is laid on longitudinal stringers. The preparation for the change of gauge on this part of the line included opening up the ballast and cutting through a portion of the cross transoms, so that when the day for the change came the remaining transoms could be cut, and the longitudinals and rails transferred to the standard gauge.

It was expected that about 5,000 men would be employed in the work, being distributed along the line in gangs of 60, and it was hoped that the actual work of change of gauge would be completed on Saturday, and that Sunday would be sufficient to put things in order to resume regular traffic on Monday morning. About 25 miles of sidings were built at Swindon on which to mass the broad gauge rolling stock before the change was made. Between 3,000 and 4,000 vehicles had to be collected east of Exeter by Friday night. Nearly all of the passenger carriages were narrow gauge coaches on broad gauge trucks, so that the work of changing these would be short. It was expected that the entire change would cost about £1,000,000.

The Fontaine Continuous Railroad Crossing.

On Tuesday, May 31, the Fontaine Crossing Co. ran an excursion train from Chicago to Hannab, Ind., over the Pittsburgh, Fort Wayne & Chicago Railroad, to show the Fontaine Continuous Crossing in actual service at



PUNCHING AND SHEARING MACHINE.

Mr. Sprague for an electric locomotive of not less than 700 H. P. to handle the traffic. The Thomson-Houston Co. will also, it is said, build a locomotive of similar capacity for the same work.

Following quickly upon this action of Mr. Villard comes the news of the determination of the Baltimore & Ohio Railroad Co. to equip the tunnel of the Baltimore Belt Railroad with electric locomotives and the necessary power plant. Although various reports have been published as to the details of this work, it was not until the close of last week that the details of the contract were finally settled. As far as can be ascertained, the contract involves the building, for delivery early next year, of three 8-ton locomotives, which are to develop, approximately, a draw-bar pull of 31,000 lbs. at 15 miles an hour. A station of about 2,500 horsepower will be installed with four units and direct-coupled engines and generators. This station will be midway in a run of 12,000 ft. The maximum work required of each locomotive in developing this drawbar pull is to move a 1,200-ton freight train over a grade of about eight-tenths of one per cent. at 15 miles an hour; and in passenger service, to move a 500-ton train at 30 miles an hour over a similar grade. Each locomotive will also be expected to serve as a reserve or assistant engine for the regular steam locomotive just outside the tunnel, when the latter is hauling a freight train up a grade of 1 $\frac{1}{2}$ per cent. All told, there will be about 200 trains a day of each class. The tunnel is also to be lit by electricity.—*Electrical Engineer.*

Change of Gauge on the Great Western of England.

The last of the broad gauge track on the Great Western Railway of England was converted from 7 ft. gauge to the standard gauge on Saturday and Sunday, May 21 and 22. We hope to give shortly a somewhat extended account of this work, but meantime give the following particulars. The Great Western has a mixed gauge from London to Exeter, that is, a third rail is used. Beyond Exeter the main line was all broad gauge except a short piece between Truro and Penzance. The broad gauge line west of Exeter was about 200 miles, and including second track and sidings there was about 300

the crossing of the Pittsburgh, Fort Wayne & Chicago and the Chicago & West Michigan. Invitations were extended to the various railroad officials of the roads entering Chicago, and also to the representatives of the railroad technical papers. The train was run over the crossing at a very high speed in order to demonstrate to those on board the smoothness of crossings under such circumstances as compared with the ordinary crossings. There was very little noise and no jolting perceptible to those on the train, and unless one was watching for the crossing it would not be noticed. The train was stopped and backed up to the crossing, where the party disembarked and examined the crossing and the interlocking system connected with it. Two freight trains and the fast Keystone Express for New York over the Pittsburgh, Fort Wayne & Chicago passed over the crossing at high speed. All present were well pleased with the action of the device. The safety of the interlocking devices was demonstrated, as the locking device would not operate unless the motion of the crossing turrets was absolute. The Fontaine Crossing was fully described in the *Railroad Gazette* of June 19 and Dec. 18, 1891. Representatives from nearly all the railroads entering Chicago were present, and much interest was shown in the devices exhibited.

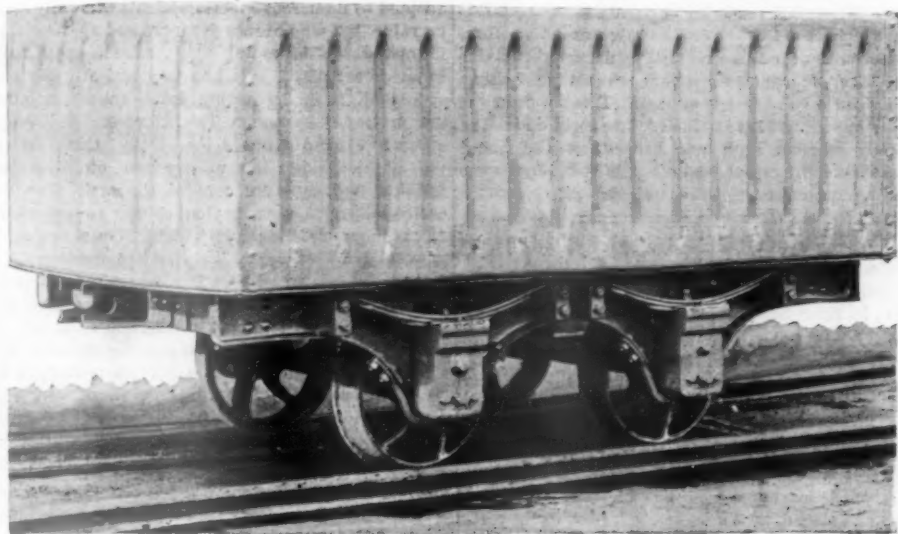
The Franklin Institute on the Rhode Island Compound Locomotive.

The committee appointed by the Franklin Institute to examine into the application of the Rhode Island Locomotive Works for the Elliott Cresson medal for a compound locomotive cylinder arrangement invented by Mr. C. H. Batchelor, Chief Draftsman of the Rhode Island Locomotive Works, has made its report. The recommendation of the committee is as follows:—
"We have here the most scientific development of a

two-cylinder compound engine, automatically adapted to all requirements of variable service. Your sub-committee having examined the mechanisms and applications of these improvements in detail, as well as all the disinterested records of the same at its command, and having carefully noted and compared the devices and claims therefor, of other inventions for a like purpose, concludes this report by recommending the award of the Elliott Cresson medal to Mr. C. H. Batchelor, for his invention.

The committee has based this report on tests made of the locomotive in question by the Rhode Island Locomotive Works. These tests are given in the first appendix to the report. The tests are those which we have before published (see *Railroad Gazette*, Jan. 9, 1891, and Dec. 11, 1891), and were made on the New York, Providence & Boston, the Boston & Albany, and on the Union Elevated Railroad in Brooklyn. The tests were sent out to the public by the Rhode Island Locomotive Works some time ago in a circular. The second appendix to the report describes existing inventions and mechanisms devised for operating two-cylinder compounds and contains data respecting English, French and United States patents on devices used in connection with two-cylinder compound locomotives; also other data bearing upon the use of steam in compound locomotives. The report is a rather long one and contains some interesting matter, most of which has been before published, about the practical use of designs of compound locomotives already built. The following paragraphs from the appendix more particularly refer to the Rhode Island compound, and indicate somewhat the ground of the committee for recommending the granting of the Elliott Cresson medal for the Batchelor invention:

"When starting a locomotive its greatest power is



PRESSED STEEL COAL CAR.

By the LEEDS FORGE COMPANY, Leeds, England.

needed, this may also be needed to overcome occasional resistances at any time along the roadway. That locomotive, therefore, which is supplied with mechanism at the will of the engineer, capable of running the engine at full power at any time and for any length of time, and as easily convertible into compound running, must take the precedence over every other. . . . We are more concerned here, however, with the appliances by which any type of compound locomotive may be made *universally applicable to any road and to any service*. This invention is not simply ingenious, although it takes rank with any having high merit in that particular, but the merit we desire to report favorably upon, and give award to, is of such character as possesses commercial value. A two-cylinder compound can be put to any simple engine for less cost than other type, and in doing so will replace and require the least number of working parts. The altering of existing simple engines into two-cylinder compounds, is thus made altogether feasible, and the building of new ones can be done at a cost very little over simple ones of same type and power. The Rhode Island Locomotive Works improvements solve these problems perfectly. They furnish a locomotive that, for any time and service, is at once simple or compound—an accomplished fact which your committee believes has not been done before in any country. A great number of two-cylinder compounds, having the Worsdell-von Borries type of valves and steamways have been made, and are now running with good economical results. If, therefore, the two-cylinder type of engine is so well favored as those referred to, which are limited to certain kinds of traffic, adapted to the special construction of these engines, how much more will the same type be valued when it is suited to every service, by being perfectly interchangeable, with full range of performance, either as simple or compound. . . .

The *early state of the art* shows that ordinary cocks and slide and other forms of valves operated by the engineer have been used for admitting steam to the low pressure cylinder directly from the boiler for starting the engine, to be operated again by the engineer, changing the engine to compound running when the extra resistance is overcome, some having independent escape to the atmosphere for the high pressure cylinder and some having closed exhaust chambers. The *advanced state of the art* exhibits the use of valves in the high pressure cylinder exhaust pipe or receiver, which are worked by steam automatically or otherwise. The greater number of these valves are opened automatically by the high pressure cylinder exhaust steam when its accumulated pressure exceeds that of the admitted wire-drawn live steam to the low pressure steam chest. These are called "intercepting valves," and no means are provided for holding them shut for continued simple running. Your committee plainly sees that any engine, exhausting into a closed chamber must weaken after the first revo-

lution and must gradually cease to have power if this process continues, and that this effect happens just at the time when the greatest power is needed; and again when this chamber gets relief the engine at once ceases to be a simple engine and goes into compound working. If the engine has not got under way by this time it must balk and simple running be tried over again. . . . The *perfected state of the art* must exhibit a two-cylinder compound locomotive engine, whose mechanism is simplest in form and number of working parts and whose steamways are most uniform in section and most direct in course from boiler to the point of application. In so far as your committee has ascertained from every reliable source at its command the mechanism devised by Mr. C. H. Batchelor practically fulfills this requirement.

In this engine we have all the necessary devices by which a locomotive may be run at any time and at any place on the road and for any length of time demanded by the service, as a simple engine; each cylinder doing exactly half the work, whatever that may be, and without waste of steam. In addition to this, at the will of the engineer and at any time he chooses to exercise it, according to the conditions of running, he changes his engine into compound working, permitting it to operate thus as long as circumstances will warrant, and then he changes it back again at once into simple working. These changes are made as easily as the engineer turns his hand to open or close one valve, by a handy lever in his cab, and he does this when the engine is standing or running.

Smokeless Locomotives.

The Secretary of the Society for the Prevention of Smoke has addressed a letter, bearing date of April 30, 1892, to the managers of the railroads entering Chicago, and also to the division heads of the Brotherhood of Locomotive Engineers, relative to the abatement of the smoke nuisance in that city.

The letter to the Brotherhood in effect says: The So-

ciety for the Prevention of Smoke is an organization supported by private subscription. It is free from politics and interests in patented devices for the suppression of smoke, and it is absolutely independent of any other organization. Its existence depends upon the liberality of those public spirited citizens, who wish to see the smoke nuisance abated. Their employees are selected for their ability to fill the places to which they are appointed. The society endeavors to abolish the smoke, not by prosecution, but by telling violators of the law of the cheaper and most effective methods to use, that will relieve the nuisance. Prosecution is the last resort for indifferent offenders.

The letter to the managers says in effect: After conducting two months of continuous service tests on locomotives with various devices and appliances the Society feel justified in recommending the use of the devices below.

- (a) The Lape or Barnes device used on the Wabash R. R.
- (b) The Western Smoke Preventer used on the C., B. & Q. R. R. and elsewhere.
- (c) The Nutting device used on the Illinois Central R. R. and elsewhere.
- (d) The Walker device used on the C., M. & St. Paul Ry. and elsewhere.

This arrangement is given because the last two are more noisy than the first two, but are practically as effective and more liable to be shut off by the engineer or fireman, as the noise is very trying.

The Hutchinson device is not as effective as those mentioned, but its continued use will reduce the amount of smoke, and render the users less liable to prosecution for infractions of the law. After Sept. 1, 1892, the Society will begin proceedings in earnest, and prosecute without delay, against all offending railroads. It is believed that 100 days is sufficient time to make necessary changes in engines to apply the device. The devices must not only be adopted and applied, but must be used. The adoption and use of any other device not recommended will not be found fault with. The Society will cheerfully give any help or assistance in its power, if called upon.

The Society summarizes its views as follows: "To the

railroads we say, give your men every facility and opportunity to control the smoke. Make it as easy for them as possible. By doing this you serve your own and the interests of the public. To the engineers we say, be as diligent and careful as you reasonably can in using every means at your command to suppress smoke. By doing this you will serve your interests and those of the public."

Pressed Steel Coal Car.

The illustration shows a pressed steel coal car made by the Leeds Forge Co., Limited, Leeds, England, under the Fox patents, for use in underground workings. These cars are designed more particularly for carrying coal and are adapted to be used either in the pits or for taking coal from the pit mouth to boats or cars for shipment. The underframe is made of pressed steel parts $\frac{1}{4}$ of an inch thick and is not unlike the Fox freight car truck used in this country, except that the framing has end sills. The truck is 7 ft. long and 4 ft. wide. The sides of the body are $\frac{3}{4}$ of an inch thick and are corrugated to give rigidity and obviate the need of stays or stakes. The total weight, including wheels, axles and springs, ready for use, is 720 lbs. These cars have proved very satisfactory in English colliery work on account of their light weight and small cost for repairs.

The Monier System of Iron and Cement Construction.

The Monier system of iron and cement construction, of which so much has been said and written in the past year or two, is made the subject of some interesting notes in a recent issue of the *Revue Industrielle*. Mr. Monier's system, which is patented, consists, as is now pretty well known, of a combination of comparatively light iron rods, which form a sort of frame work, and of cement mortar, which is poured around it, the combination forming, it is claimed, a structure of great strength and comparative lightness. The questions which have presented themselves in connection with it have been these: Will not the iron rust under the conditions of its use? Will it adhere well to the cement mortar? What will be the influences of changes of temperature? It is held that the iron in the cement is protected against all outside corroding agents, and can, therefore, not rust. Several years' experience with some Monier work is said to have established this beyond doubt. As to the adherence between the cement and the iron this also has been found to be excellent, and a number of experiments made to test this point are said to have given satisfactory results. The answer to the third question concerning temperature effects appears to be the most doubtful. It is naturally to be feared that in submitting to varying temperatures a collection of materials having such co-efficients of expansion as cement and iron, a general breaking up would occur. Still, M. Monier's experiments in this direction also are understood to have given good results. The advantages of the Monier system are summarized as follows: Solidity, lightness, low cost, and rapidity of construction. For all work where water tightness is necessary the system is recommended. When it was first proposed to follow the system in the building of the aqueduct to supply the Vienna Neustadt with water an experimental gallery, measuring 3 x 4 in., with walls 5 2 in. thick, was built and tested to destruction, the results, as given, being in favor of the system. In the construction of gas holder tanks and gas mains it may again be applied equally successfully. Its use in bridge building, however, is one of the latest and most novel applications. Test arches which have been built, and bridges for regular traffic have all behaved well, and their performance has added not a little to the general advertisement of the system. The article in the *Revue Industrielle* is accompanied by 16 illustrations, showing the various dispositions of iron framework which may be adopted for different purposes.

An Experiment with Aluminum in Iron Castings.

Some experiments with aluminum in iron castings have been made by Mr. W. Wallace Christie for the Hamapo Iron Works. The results are given in a paper read before the San Francisco meeting of the American Society of Mechanical Engineers. The results of the experiments as given in this paper are about as follows: Two mixtures for cast metal were made and the castings tested. The mixtures were:

	Mix. No. 1.	Mix. No. 2.
	Lbs.	Lbs.
Wrought iron turnings.....	10	10
Cast iron turnings.....	10	5
Steel rail chips.....	10	15
Ferro-silicate of iron and aluminum.....	2	2

The melting was done in a brass foundry's furnace and required about three hours time to melt. After being melted the ferro-silicate of iron and aluminum was added and thoroughly stirred into the mass. The castings were made in green sand molds without charcoal facing. When the skin of sand was removed the castings were found smooth and clean. The castings were 1 1/2 in. diameter by 14 in. long.

There was some difference found in the metals when under heat, mixture No. 1 being very fluid when hot and white and had to be poured quickly as it cooled rapidly. It made a homogeneous casting, had a very bright fracture and could not be cut by a specially hard tempered tool. Mixture No. 2 was not so fluid or so white when melted; casting was not so homogeneous and had a duller fracture. It was very hard and resisted cutting tools more than No. 1. Both specimens retain their original brightness of fracture after a year's exposure, crumble at a high red heat and could be worked slightly under a steam hammer at a dull red heat. Mixture No. 1 flattened to 1 1/4 in. and No. 2 to 3/4 in. before crumbling. No. 1 was subjected to a tension test after being remelted and cast into suitable shape. It broke at 44,700 lbs. per sq. in., the fracture occurring in the jaws of machine, and in the large section owing to a cinder flaw in casting. The tensile strength would have been higher but for the flaw in the casting and the uneven grip in the jaws of the machine. In the impact machine, with six inches between supports, a weight of 25 lbs. falling 1 1/2 in. was required to break a circular section of 31 sq. in. The ferro-silicate of iron and aluminum used was an ordinary commercial article. The writer suggests using these mixtures for floor plates where wear and not strength is needed, and for bearings for pivots. The metal cannot be worked in machines owing to its extreme hardness.



ESTABLISHED IN APRIL, 1856.

Published Every Friday.

At 73 Broadway, New York.

The subscription price is \$4.20 a year in North America, and \$6.08 in foreign countries.

EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

From the Blue Book showing the brake equipment of passenger stock in the United Kingdom at the end of 1891 we find that 91 per cent. of all vehicles run in passenger trains was equipped with the three brakes, which comply with the Board of Trade's requirements, viz., automatic vacuum, 34,513, Westinghouse, 17,534, and Steel McInnes, 34. At the end of June, 1891, the percentage so equipped was 86. In 1884, 44 per cent. of all carriages, etc., was equipped with these three brakes. Since then the progress has been uninterrupted, each half year's returns showing a gain on the preceding half year. At the end of 1891 the engines equipped with apparatus for operating these brakes were 93 per cent. of all; or automatic vacuum, 8,260, and Westinghouse, 2,455. In most cases these engines have steam driver brakes also. At the end of June in the same year they were 83 per cent. The passenger train miles run with this equipment were 78½ million or 87 per cent. of all the passenger train mileage of the United Kingdom. There are in use in passenger service of the United Kingdom half a dozen other continuous brakes which comply with some, but not all, of the conditions of the Board of Trade, but the use of these is quite limited. The carriages fitted with them were 2,875, and the passenger train miles run by this stock were 8.6 million, or 9.7 per cent. of the total. Finally, there are 7,716 vehicles not fitted with continuous brakes, but of these 5,942 are piped.

The Board of Trade requirements, which we have repeatedly published, and which were put in force in 1877, are that the brake shall be efficient, instantaneous, easily applied, automatic, capable of being put on or released from the engine or any vehicle of the train, in regular use, and durable. It is well known to our readers that the half yearly returns contain reports from the railroad companies of failures of the brakes to work and of delays to trains caused by them, and we have several times analyzed these reports to ascertain the relative efficiency of the two brakes mostly used. The classification of brake failures is: (1) Failure to act when required in case of accident to a train or a collision being imminent. (2) Failure to act under ordinary circumstances to stop a train. (3) Delays to traffic because of defects or failures, etc. Leaving out all the cases where the trouble came from the fault of employes, we find that of the second class the Westinghouse had .011 failures in a million train miles and the automatic vacuum 0.06. Of troubles of the third class the Westinghouse had 5.51 and the automatic vacuum 5.4 for each million train miles. This is leaving out cases of bursted hose on the Westinghouse cars. These almost doubled the cases of delays. For three half years in 1890 and 1891, of which we examined

these returns, the automatic vacuum made twice as many failures of the third class and nearly twice as many of the second as the Westinghouse; but in this last half year the conditions have changed apparently. With neither brake was there any failure of the first class. This is a wonderful record when you consider that it is for 78½ million passenger train miles, or 94 times the passenger train movement of the Pennsylvania Railroad in 1890. It suggests, not that brakes are more efficient in England than in the United States, but that an English runner is seldom caught without enough warning to apply his brakes.

Last week we published an article by Mr. Kreuzpointer on firebox steel, in which he describes the various causes of laminations and defects in the structure of steel, but we cannot see that he has shown how to detect a lamination in a steel firebox plate. He recommends polishing the edges of the plate and etching with acid or nicking the plate and bending it over. No one can doubt that either of these tests would show a lamination, if one existed in the piece that is bent; but if the lamination is in the centre of the plate and a test piece cut for determining lamination is taken from the edge, it is not clear how such test piece, whether it contains a lamination or not, is any indication of the structure of the steel in the middle of the plate. The test proposed would be all right provided in every instance the lamination extended throughout the plate; but the fact is that many times there are local laminations which do not extend to the edge, and, therefore, any test to be of really practical value must consider the centre of the plate, which cannot be etched; neither can it be nicked or broken. It is not clear yet that we have a test for laminations that will determine certainly whether such are present in the centre of a firebox plate or not, and we must still rely on the honesty, skill and care of the steel makers.

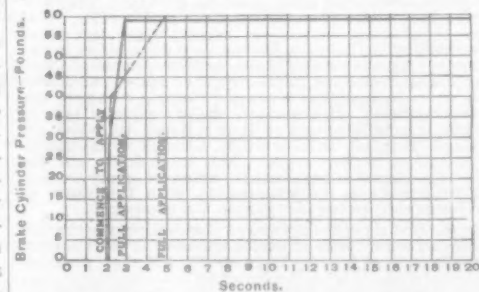
Some one has said that the degree of civilization of a nation may be measured by its consumption of iron. This doubtless would show ancient Athens, and Florence in its flourishing period, to have been barbarians compared with modern Egypt or the Sandwich Islands—not to get nearer home; but there is probably some relation between iron consumption and the progress made in material production. That is, the people who consume most iron probably increase the production of their industries in general faster than those who consume less. Judged by this, Russia must be a long way from the head of the procession. Its production of iron and steel of all kinds in 1889, plus its imports in that year, which must have been substantially equal to its consumption, amounted to only 1,615,962 long tons in 1889, or to only 40 lbs. per inhabitant. In this country last year (when the consumption was less than the year before) 65,000,000 of us made way with nearly six times as much iron as the 90,000,000 of Russians, or about 300 lbs. apiece, so that we may conclude that we have seven and a half times as much sweetness and light as the Russians. The latter are trying hard to get more, however, or at least the government is, and has called upon the railroads to help. Protective tariffs have already created an important iron industry in Russia; and its domestic production of iron and steel in 1889 was nearly seven times as great as its imports; moreover the railroads and some other consumers for some years have been required to purchase rails, etc., of Russian manufacture solely. But the producers are few, the competition among them limited, and the cost of unmanufactured iron is said to be so great that those manufactures which require much iron to work up do not make satisfactory progress. Unfortunately the chief deposits of ore are in the extreme East of European Russia, while the larger part of the population is in the West, which makes a great deal of transportation necessary. To lessen the burden of this, new and greatly reduced rates on ores and unmanufactured iron were introduced last March, which will, it is hoped, greatly facilitate consumption. As the railroads have dividends guaranteed, only those of them can complain which earn more than the guaranteed dividend. That is, the measure is in the nature of a subsidy to the consumers (perhaps to the producers also) of iron, the cost of which subsidy will be advanced by the railroads, and eventually, in most cases, refunded by the government.

On the Norfolk & Western, where the block system has been used for nearly three years, there is one peculiarity which we have not seen anywhere else, and that is that freight trains are blocked one way but not the other. All eastbound freight trains are blocked throughout a division 130 miles long, while westbound

freight trains are run by the time interval system, under the old rules, the interval being 10 minutes. Passenger trains are run under the absolute block system in both directions. The reason for adopting this arrangement is a very practical one, and illustrates how rigidly the question of expense limits the power of a superintendent who may wish to seek "safety first and speed afterwards," on a road where the traffic is not heavy. The explanation is simple; there has been no trouble from rear collisions with westbound trains, whereas there was some trouble of this kind with eastbound trains. These are heavy, consisting largely of coal and coke, and the increase of weight in loaded cars during the last few years has of course been marked here as elsewhere, and the difficulties incident to handling trains on steep grades have doubtless increased, as they have on nearly all other roads. On the other hand, the westbound trains are composed almost entirely of empty cars, and are easily controlled. But notwithstanding this difference, one naturally asks why, in view of the fact that operators are on duty at every station, and every one of them familiar with the block system, it is not just as easy to block all trains as to block only half of them. But here we come to the stubborn fact that a space interval system, rigidly applied, does involve constant delays, unless additional telegraph stations are established. The delays are often small, but numerous enough to be very annoying. This is found to be the case on nearly every road. It is the immediate reason why the block system is not adopted by numerous superintendents who fully realize its value, but who cannot get increased appropriations for operators' salaries unless they have been so unfortunate in the past as to be able to practically prove that there will be a big saving in the future by adopting a safer system. The Norfolk & Western officers evidently save a little time by the use of the time interval system on westbound freights, and thus are enabled to waste time with eastbound trains to such extent as may be necessary to block them a station apart without establishing the new telegraph offices which would be necessary if all trains were treated alike. The westbound trains run 20 miles an hour. The Norfolk & Western now operates the block system on 246 miles of road. On the Lynchburg division, 130 miles long, the system is operated as above described. The daily movement on this division is about 45 freight trains, all of which are double headers, and eight passenger trains. On the Radford division, 105 miles long, the freight trains are generally run under permissive signals. The remaining 11 miles is on the Pocahontas division.

Quick and Slow Acting Brakes.

At one of the public meetings of the Master Car Builders' Committee on Air Brakes, the argument was offered that a brake that would commence to apply on the rear of a 50-car train in the short time proposed, namely, less than three seconds, and thereafter more slowly attain to full pressure than was proposed, namely less than 3½ seconds, would, if it finally equalized to a higher pressure, produce a shorter stop and less shock. Several tests were cited to prove this claim, and the data from those tests were presented. Such claims as this have been made before, and are now advanced by those who are interested in brakes that slowly reach full application after they commence to apply. The fallacy of this reasoning about quickness of application does not appear at first and not until the numerical values are given to the times and pressures of application.



To illustrate the action clearly and conclusively, we have prepared a diagram of braking power pressures, which shows the actions of two brakes; one a strictly "quick acting" brake, with which the brakes commence to apply at the end of a fifty-car train in 2.2 seconds, and are full on in 3 seconds; and the other a comparatively slow acting brake, commencing to apply at the same time and not fully applied until 5 seconds have elapsed. The first, as shown by the full line on the diagram, fully applies at 59 pounds, and the other at 60 pounds, as shown by the dotted lines.

The areas of the diagrams up to any point of time are measures of the retardation of the brakes up to that point as long as the speed of the train is constant; but as the speed decreases after the time of the first application of the brake shoes to the wheels, the areas of the diagrams are not correct representations of the comparative amounts of brake work done on the train by the two brakes being compared. Therefore, one must look further than this for a proof of the superiority of the brake that is fully on in the shortest time.

Manifestly that brake is best which forces the shoes hardest against the wheels at the higher speeds, as then the distance traveled over by the train, and the distance that the shoes travel over the surface of the wheels are greater. The work done by a brake shoe in a given time is proportional to the number of feet of the tread of the wheel which passes under the shoe in that time (this is, of course, with a practically constant speed), and, therefore, the most work will generally be done by the brake which applies the shoes hardest at the highest speeds. Hence, the area between the dotted line and the full line before the full application of the slower brake represents an actual increase of work done to stop the train in the first three seconds; but, as before stated, the increased area does not give directly the increase in brake work done, for the reason that the actual increase of work is greater than the increase of area shows. That is, the increase of area shown before full application indicates more effective work done in stopping the train than a simple comparison of the areas would show.

The increase of one pound per square inch in the cylinder during the latter part of the stop is not the equivalent of the gain in the first part and is, besides, detrimental, as the ideal brake for an emergency stop is one that will apply instantly with full and very great force when the engineer's valve is opened, and will thereafter become reduced so as to gain the greatest stopping force without skidding the wheels. The greatest retardation is gained just before the wheels commence to slide on the rails. Several times as much pressure can be applied to the brake shoes when the train is at a speed of 60 miles per hour without sliding the wheels as can be applied at five miles per hour. This is because the coefficient of friction is much reduced at the higher speeds; hence, it is clear that the ideal brake is one that will apply with great force at high speeds and be reduced in force as the speed is reduced. Evidently the ideal is more nearly approached by the brake having an action, as shown by the full line on the diagram, than by the one having an action, as shown by the dotted lines. All this was conclusively proved by the Burlington brake trials in 1886, and is not a new argument to those who have studied the results then obtained.

What Is the Interstate Commerce Law Good For?

The above question, with a discussion showing that the writer sincerely believes that the true answer to it is of a decidedly negative character, has appeared in a good many newspapers since the publication of the decision of the United States Supreme Court on the party-rate case; and it is clear that the rather vague criticisms of the law which have appeared whenever the inadequacy of some one of its provisions has been brought out by this, that and the other complaint, have in the aggregate served to create in the minds of many editors and others a settled feeling that this law, designed to cure a great variety of evils, is, after all, made up of a parcel of unsound doctrines and therefore is really capable of doing no good at all. Our title is not a verbatim copy of all those which we refer to, but it truly represents the sense. Some of the most intelligent of the daily newspapers seem to be gradually giving up to the view, held by a good many people in the West, that the Interstate Commerce law is either a disguised attempt of the wealthy East to oppress the poor people of the West or else is a clumsy and useless theory.

These disappointed people have expected too much from legislation, and the failure of their expectations is a natural result. The trouble must be due chiefly to their careless reading of the law. The fact that these false hopes have been indulged in for five years does not make them any less false. It is true that the decisions of the Interstate Commerce Commission have helped very materially to sustain these erroneous views. Many of these decisions, especially during the earlier years, carried the implication that the law was a strong and rigid fabric, capable of sustaining the right and crushing out wrongs to an unlimited extent. When the sagacious and experienced men who wrote the earlier decisions of the Commission felt that their dicta were firmly founded on justice and the true principles of the common law, they uttered them without apology or qualification; and this assumption of the writers

having proved correct, the decisions stood. But those who now complain that their doll is made of sawdust gave all the credit for the good results of these decisions to supposed specific provisions of the Interstate Commerce Law. A great many of the questions that came before the Commissioners, or rather of the questions that they discussed and decided, were of such a nature that the verdict had to be a compromise, but Judge Cooley and his colleagues succeeded for a long time in adjusting these compromises just about right, and so this false confidence in the law as a whole kept growing and becoming strong by the mere lapse of time. But after awhile the easy questions were disposed of and harder ones came up; questions on which a decision based on common sense would not be accepted by rival interests, because they preferred to fight it out to the death; and the trouble began. Judge Cooley made some mistakes, and his ill health, together with the retirement of other well qualified men, led to the decision of important questions by men who were pretty sure to make mistakes even when not in ill health.

The discussion of the party-rate case illustrates the superficial way in which people have looked upon the Interstate Commerce law as a magic device to perfectly preserve the balance between conflicting interests involving billions of money. In the first place, nearly every one assumes that, if the courts had not given this decision, the opinion of the Interstate Commerce Commission, forbidding one-way party rates, would have had the force of law. Those who do not assume this discuss the matter as though they more than half assumed it and thus keep up the false impression. But it is as plain as the title page of a dictionary that the Commission has no such power. Those sections of the law defining its authority make very clear the fact that its powers in rate making are recommendatory only. Moreover, the distinction between one-way party rates and excursion rates, which are generally round-trip party rates, is exceedingly fanciful if not wholly arbitrary, and the decision of the Commission was entirely dependent upon this distinction for its force, as "excursion tickets" are specifically excepted from the operation of the law. This being the case, those roads which chose to ignore the Commission's order on the ground that it lacked the main element which should give force to such an order—common sense—had strong justification. Those roads which abolished one-way party rates and took so much pains to announce that their action was due to their respect for the law probably in most cases deemed the abolition good policy, in their respective cases, law or no law. This is an instance of the fact that railroad men as well as other people have done a good deal to give a fictitious importance to certain features of the Interstate Commerce law. Everyone has noticed how the implied prohibition of free tickets, found in certain sections of the law, has been seized upon by managers to cut off passes in other cases where the law had nothing to say on the subject, but where the managers had not the courage to declare the real reason for freezing out their "friends."

The application of the wholesale and retail principle in railroad rates, as we pointed out last week, was one of the two simple questions decided by the Supreme Court, and the decision shows with perfect clearness that that principle, when not abused, is not disturbed by the Act to Regulate Commerce; but newspapers discussing the matter seem to become befogged by unofficial utterances of this, that or the other "authority," and anxiously inquire what is to become of that important section of the law which was designed to protect small shippers against the greed and power of large ones. But right here is found the best evidence of the wisdom of the framers of the law. Knowing the impossibility of trying to enforce high rates on cheap goods, or unduly low rates on merchandise which can afford to pay better, which would have to be done in defiance of the most powerful natural laws of commerce (it is done with postage rates by sheer force of government money), they carefully adjusted the law so as to empower the Commission to repair this kind of injustice where it might be found possible to do so, and to keep its hands off where the problem proved too complex to be successfully undertaken.

Other inquirers mix up their discussions about the affirmation by the Court of the wholesale-and-retail principle with anxious fears about the extent to which the principle may be applied. But the Court took particular care not to touch this point, and it is left, as before, to be watched by the Commission; and it comes peculiarly within the province of a commission. Railroads must carry trainloads and carloads of passengers cheaper than transients, in order to make the best use of their cars and other facilities, and to be able to serve the public at the most economical rates; but this fact

does not warrant them in carrying a horde of drummers at less than cost, to stimulate competitive freight business which is of doubtful value in itself, nor in selling 5,000-mile tickets at very low rates to scalpers who will advance the road a few thousand dollars when the treasury is empty—to the injury of good customers who can afford to buy only 1,000 miles at a time. The Commission has the authority, and should have the power and facilities to look out for abuses of this kind. It is true that the Commission has a delicate task to perform in deciding whether party rates at 10 per cent. discount should be granted to parties of 5, or only to parties of 10 or 15; but the existence of delicate questions is just what led to the creation of the Commission. Questions which are easily settled can be provided for by rigid laws. It is true also that settlements of delicate questions do not "stay put" as one would like to have them, but what better can we do? Is it not better to have them aired than to let discrimination go on undisturbed?

The good and the evil in the Interstate Commerce law have come to be quite clearly defined and separable, and there is no sense in the demand for the repeal of the law as a whole. The prohibition of pooling, so far as it was obeyed, undoubtedly tended to promote consolidations and traffic agreements like that between the Chicago & Northwestern and the Union Pacific; and to intensify competition in other cases, whether to the benefit of the public or otherwise, the public will find out some time in the future, probably. The rigid application of the long and short haul section has doubtless done harm to particular roads in some few cases, and to some sections of the public served by those roads. Whether those whose interests have thus been sacrificed for the benefit of the larger public which has been benefited by the fourth section can be induced to submit always to the inequality remains to be seen.

These two features, broadly speaking, embrace the serious objections. All other criticisms of moment refer to sections which have failed because the Commission could not or would not enforce them. Publicity of rates is good, and reforms have been accomplished by it. But the Commission needs 50 members instead of five if it is to enforce this section. Unjust discrimination is possible even with the utmost publicity of tariffs and honesty in using them, and many evils of this sort will always be beyond the power of any law or commission to cure; they must be left to the action of natural laws; but it is noticeable that the worst discriminations now complained of are those perpetrated by direct violation of the section requiring publicity. The whole difficulty lies in the doing of acts admitted to be wrong, in defiance of a law admitted to be right. Why repeal such a law? It would be just as reasonable to repeal all tax laws because there are numerous tax dodgers. Tax assessors have thus far been unable to enforce justice when half the property owners are liars, and five Interstate Commerce Commissioners will be unequal to the task of reining hundreds of railroad officers into line as long as the individual states promote disorder by building too many railroads, and Congress abets the evil by letting them fight each other with barbarous weapons.

Clearly, numerous things are beyond the power even of the most capable commission, but when we consider the limitation of salary and the demands of politics which hamper the President in appointing Commissioners, we must make the list of impossibilities still larger. It must be remembered that some of the weightiest criticisms of the Commission have been those based on the conviction that certain decisions made by it were tinged with political motives, but that is no fault of the Interstate Commerce law. One of the best features of that law is that providing for the Commission. The best function of the Commission is to act as a lubricant between railroads and the public. In this the law is based on the best previous laws of the kind, those of England and Massachusetts. But the strength of those laws lay chiefly in the ability and character of the Commissioners appointed under them, and we must not blame the law because the conditions of our political system prevent a fair trial of it. If we repeal it now because of its failures, let it be understood that these are due not to the construction of the act itself (except in the matter of salaries), but to deficiencies or faults in its administration.

High Speed Electric Railroads and Air Pressures.

In a paper before the San Francisco meeting of the American Society of Mechanical Engineers, entitled "The Electric Railway as Applied to Steam Roads," Mr. B. J. Dashiell, Jr., gives some deductions from experiments made by Mr. O. T. Crosby and published by him in various papers, notably a "Report on High Speed Electric Railway Working" before the American Insti-

tute of Electrical Engineers in 1891; "The Limitation of Steam and Electricity in Transportation," before the same Institute, May 21, 1890; and "An Experimental Study of Atmospheric Resistance," before the West Point Branch of the United States Military Service Institute in 1890.

Mr. Dashiell begins by saying that "it is the intention of the writer to give some information for record before this Society which will throw light upon the question of high speed train resistance deduced from tabulated experiments at such speeds." The data that he gives were taken from experiments made by Mr. Crosby with a 2½-ton motor on a circular road. The results are interesting in what they indicate rather than in what they prove. The table giving the air resistance at various speeds is the most useful, if correct, of the data presented. The air pressure per square foot on a surface having 5 sq. ft. of area is as follows:

Speed in miles per hour.....	10	20	30	40	60	100
Pressure in pounds on 5 sq. ft.	7.5	15	22.5	30	45	75

Of course, the pressures on larger areas, such as those common with railroad trains, will be somewhat different, but it is probable that the ratios of the pressures on larger areas at different speeds would be about the same as those given for five square feet. It was noticeable in the Forth bridge experiments that the large board, 15 × 20 ft., had a pressure on it averaging about 10 lbs. per sq. ft., while the smaller board, having an area of 1½ sq. ft., under the same conditions, registered 31 lbs. per square foot. The difference was due, perhaps, to the friction on the periphery of the board, which is manifestly greater in proportion to the area on the small board than for the large board. Therefore, it might be expected that for large areas, such as the front end of an ordinary railroad train having 90 to 100 sq. ft. area, the pressures per square foot would be less than those obtained by Mr. Crosby. Hence, it may, perhaps be safe to use as a maximum figure the pressures per square foot which he obtained at the various speeds.

It is to be regretted that Mr. Dashiell has not given in his paper the plan followed in compiling the table. He says: "By careful study the writer has been able to compile a table of train resistances on a level where heavy rails and good track construction were the aim of the railroads making these speeds. The table gives the total resistance at various speeds and various areas exposed to the atmosphere per ton of locomotive and train, using Trautwine's table of resistance for curves. Thus the total resistances other than those due to the atmosphere were found to be at 120 miles per hour 20 lbs. per ton of moving weight, and at 60 miles per hour 12.8 lbs. per ton." It is not stated how these last results were obtained, and before the tables given can be relied upon an explanation should be made as to this point.

From the title, "The Electrical Railway as Applied to Steam Roads," one might expect to find some data or speculation about the feasibility of operating steam surface roads by electricity, but nothing of the sort is given. Reference is made to the well-known switching motor, designed by the Thomson-Houston Electric Company, and used at Whitinsville, Mass., having a capacity of about 100-H. P., which enables it to pull a train of "6 to 12 heavily loaded freight cars" at a speed of five miles per hour.

A mail car being used in St. Louis on 16 miles of road, driven by two standard street railroad motors, is also described, and reference is made to the speculative electric road between Chicago and St. Louis, where it is proposed to run trains at a speed of 100 miles per hour. Those who have read the promises and speculations of electric companies, with respect to the operation of surface roads by electricity, and who have been led to believe that something of the sort was being done, or about to be done, and that motors of sufficient capacity had been prepared, will not find much in this paper to bear out what has been said about the feasibility of electricity for heavy service. If this paper describes all that has been done up to date, then the 100-H. P. motor hauling 12 (6) cars at five miles an hour is the maximum. But where is the Thomson-Houston 500-H. P. motor? What is wanted and what has been promised and speculated about is a motor that will haul, more particularly in suburban service, a substantial passenger train, at speeds varying from zero to 40 miles an hour, making frequent stops. A five hundred horse power electric motor is needed before the problem will approach a solution.

The Russian Government last February issued a decree requiring that all appointments to the higher offices of Russian railroad companies shall be subjected to the approval of the Minister of Transportation. The officers thus made dependent on the Ministry are: General managers, superintendents of track and buildings and of operation, storekeepers, chief surgeons, auditors, division superintendents, traveling auditors, foremen of principal shops, and the assistants of all these who fill their places during their absence. The directors of the companies now not only cannot appoint, but they cannot remove officers without the Minister's approval, so that the first care of every official naturally will be to become "solid" with the Minister. It would seem strange in this country to see a document like this:

"The Board of Directors of the New York Central &

"Four to six cars, weighing 230 to 370 tons, at five miles an hour on level.—*Electrical Engineer.*"

Hudson River Railroad respectfully request the confirmation of their election of Chauncey M. Depew as President of their company.

"Attest, the Secretary."

Approved:
"JOHN WANAMAKER."

"Disapproved," in such a case, of course, is unthinkable.

The Chicago City Council, in receiving a report from the Elevated Terminal Commission a week or two ago, summarily voted to extinguish the Commission, this result evidently being due to some sleight-of-hand trick worked by some member. This Commission, it will be remembered, was appointed by the Mayor some time ago to consider the whole subject of railroad terminals in that city. At a subsequent meeting this foolish action was reconsidered, and the vote practically repealed, but the Commission is now limited to three months' life and its expenses to \$5,000. The Commissioner of Public Works has been directed to prepare plans for the elevation or depression of the Kinzie street tracks of the Chicago & Northwestern at Rush street, together with estimates of cost, and also see what arrangements can be made with the railroad company to pay the costs.

The new and energetic Russian Minister of Transportation—an experienced railroad manager—has taken up the matter of free passes on the Russian railroads; but at this distance it looks as if he had taken it up at the wrong end; that is, it is passes to employes and their families which are engaging his attention. The data collected show that on the Russian railroads in 1888—little more than 18,000 miles—1,500,000 trip passes were granted, and more than 10,000 passes for the whole year. It is thought that this is too much of a good thing. The number of tickets sold in that year was 36,774,000. It is said that a new set of rules strictly limiting the cases in which passes may be granted has been decided upon, but it has not yet been published.

NEW PUBLICATIONS.

Dictionary of Electrical Words, Terms and Phrases. By Professor Edwin J. Houston. New York: The W. J. Johnston Co., Limited. Price, \$5.

This is a revision of the similar work by the same author and publisher, issued in 1889, but the present volume is a large octavo, and contains 562 double column pages. It is a copiously illustrated encyclopedia rather than a dictionary, and has been entirely re-written and doubled in size, there being about 5,000 definitions. The paper, typography and press work are excellent. The edition of 1889 was avowedly an imperfect one, it being a pioneer in the field. The present edition, while free from the prominent faults of the first, must still be regarded as imperfect, as such an ambitious work by one man, with little assistance, must naturally be. Moreover, the electrical arts and sciences continue to rapidly grow, and there are probably as many doubtful questions and unsettled definitions as three years ago. The electrical field has now become so broad that a work of this kind can only be made thoroughly complete by placing the different branches in the hands of specialists, who should be given due credit for their share in its preparation or supervision, and whose names would in themselves guarantee that each department had received due attention. This idea has been only partially carried out in this work.

As an example of the criticisms that railroad men will at once make, mention may be made of the fact that an illustrated description is given of an automatic block signal system, employing a battery on the locomotive—a system which probably was never used anywhere—while the electro-pneumatic block system, an important application of electricity, has only four lines given to it, and the Hall signal is not referred to at all, so far as we can see. The manual block system, as used on the Pennsylvania road, is quite fully described, but not in the best manner, the difference between absolute and permissive blocking being rather clumsily stated. This is only indirectly an electrical subject, however, and perhaps the most appropriate criticism at this point would be to recommend the omission from an electrical dictionary of all matter not strictly electrical or closely related to applications of electricity, and then it should be used with great judgment.

In the attempt to make a perfect dictionary the number of cross references has been unduly multiplied. For instance, under S we find "side B of Quadruplex table." Who would ever look for "side" in searching for information about the quadruplex? The illustrations are an important and valuable feature of the work, but some of them have been put in simply because they were pictures; they give the reader little or no idea of the construction or operation of the device which they purport to illustrate.

Notwithstanding the faults referred to, the work will be of value as a hand-book, as it brings together a large amount of information not otherwise accessible in so compact a form. Persons well versed in electrical science will soon perceive the limitations of the work and will not depend upon it unduly, while novices should understand that it is to be used as a sort of guide for use in exploring other sources of knowledge rather than as a thorough encyclopedia in itself.

Rapid Transit in Cities.—In the May and June issues of *Scribner's Magazine* appear two articles by Mr. T. C. Clarke on "Rapid Transit in Cities." In the May article he states the Problem, and in that of June gives the Solution. In both the problem and the solution he has attempted to be general, and has examined the conditions found and the efforts made in most of the large cities of the world where this matter has been considered. The articles, therefore, are decidedly worth reading. The general solution, which is indeed very general, is to design your system of rapid transit railroads in such a way that they shall radiate from the congested region into the suburbs, and so that the cars running on them can go at uniform speeds whatever the density of the population in the region through which they are passing. Therefore Mr. Clarke would recommend surface roads operated by electricity or cables in the suburbs; elevated roads where the streets become more crowded, and, finally, subways in those parts of the city where occupation of the streets by elevated structures and trains is most undesirable. This is the general solution. We would suggest, however, as a very great objection that so far cables and electricity have not given speed enough for the requirements of real rapid transit.

Mr. Clarke's special solution of the New York problem is two entirely new streets running parallel with Broadway, one of them to Forty-second street and the other to the Boulevard at Fifty-ninth street. These streets he would make each 150 ft. wide, and in each set aside 70 ft. for a viaduct of masonry and iron. This viaduct would carry four tracks and its foundations should be carried below the street level, forming subways in which freight tracks could be laid. Of course, the cost of such a system would be colossal, but Mr. Clarke is confident the increase of revenue from taxation would in a few years meet the whole annual outlay. The 70 ft. devoted to the viaduct he would lease to a company which should build and operate the railroad. He is confident that the revenue from traffic and from rental of warehouses in the viaduct would pay interest on the company's outlay. Above Fifty-ninth street much less expensive elevated roads could be run in the centre of the Boulevard, and above Forty-second street an elevated structure could be carried up Park avenue. Mr. Clarke recommends meanwhile allowing the existing elevated railroads to extend their present facilities.

TRADE CATALOGUES.

Wrought Iron and Steel in Construction. Pencoyd Iron Works, 28 South Fourth street, Philadelphia, Pa. Eighth edition.

We have often had occasion to say that a good deal of the most valuable literature for engineers in active practice is to be found in the catalogues and other special publications of the manufacturers. The little book of which we speak now is an excellent example of this. It has been prepared under the supervision of Mr. James Christie for the information of those who make use of the product of the Pencoyd Iron Works. The first edition was published in 1881. Since that time the changes in engineering practice, and particularly the great use made of steel for structural shapes, have made necessary the entire revision of this handbook, and for the 8th edition it has been entirely rewritten and considerably enlarged. Two hundred and fifty-seven pages are given to rules, formulae and tables of the dimensions, strength and various properties of wrought iron and steel shapes used as beams, struts, shafts, etc. There is a good index of 10 pages, and 43 plates serve to illustrate the sections rolled. The output of these works is unusually varied, embracing not only bridge and roof material, but turntables, axles and various other special products.

In this new edition of the handbook eight pages are given to buckled plates and corrugated flooring, giving the weights, strength, loads carried, etc., in very convenient form. Twenty-five pages are given to the special subject of iron and steel struts. Tables give the greatest safe load in pounds per square inch of cross section for vertical struts with fixed ends, flat ends, hinged ends and round ends; the tables being entered by a column expressing length divided by least radius of gyration. The tables consider built-up struts manufactured of rolled shapes, as well as integral struts. The typography and arrangement of this little handbook are excellent.

TECHNICAL.

Manufacturing and Business.

The Utah Construction Co. was formed in Salt Lake City last week to do a general construction business. The officers are: Elder R. Stewart, President; Everett W. Wilson, Vice-President, and Sebastian M. Miller, Treasurer.

The Lima Machine Works announces the sale of its manufacturing plants in Lima, O., together with all the machinery, patents and good will, to The Lima Locomotive & Machine Co., which will have greatly increased facilities. The management of the new company will be practically the same as before.

The Samson Cordage Works, of Boston, Mass., has been increasing its plant for the manufacture of "Samson" braided cord, and has recently purchased a water power near its mill, which will be transmitted

ted by electricity, as the present power is insufficient without the use of steam.

The Portland Company has just sold five locomotives to the Maine Central. Among other work the firm is building 50 log cars for the Saco Valley Lumber Co., and is also building a number of boilers for mills and manufacturing. There is a great amount of repair work on hand, and a machine has recently been added for finishing car wheels, also a cleaning machine for boilers. At the annual meeting the old board of directors was re-elected and the following officers chosen: President, Franklin C. Payson; Treasurer, Byron D. Verrill; Clerk, Rufus D. Bean.

New Stations and Shops.

Mansfield, O., has voted to bond the city for \$100,000 to secure funds to procure the change of the Pittsburgh, Ft. Wayne & Chicago division terminals from Crestline to Mansfield.

The foundations for the new Ohio River passenger and freight stations at Huntington, W. Va., have been commenced. The contract calls for the completion of the buildings by Aug. 15.

The Baltimore & Ohio will build a new station at Clarksburg, W. Va. A new yard will also be built at that point to accommodate the receiving of freight from the West Virginia & Pittsburgh.

The Great Northern road has decided to build new shops on land secured some time ago near St. Louis Park, Minneapolis. The site is located at the junction of the Minnehaha Creek and the Hutchinson branch.

The New York, Lake Erie & Western has given a contract to build a new two story freight house, 500x30 ft., on Park avenue, Weehawken, N. J. It will be built for the commerce of Hoboken, Guttenburg and Union Hill. The contractors are Grattan & Jennings, of Buffalo.

The new car and paint shop of the New York, Susquehanna & Western to be located at Paterson, N. J., will be 80x140 ft. and the machine shop 220x170 ft. Twelve acres of land have been acquired for the plant. The machinery will be moved into the new shops by June 15. The other shops and coal pockets will be completed by Aug. 1.

The Detroit City Council has granted the Wabash the right to occupy two streets with the new stone Union station which is being built at West Fort and Fourth streets. If the streets had remained open the building would have had to be built in two sections. The building will be 500 ft. long, 200 ft. wide, and six stories high. A portion of the building has already reached the third story.

The Vacuum Brake in Austria.

According to Warsaw advices, the Warsaw-Vienna railroad will fit up all its passenger trains with the automatic brake made by the Vacuum Brake Co., Limited of London. Until now the Hardy vacuum brake has been mainly used by the road, but a recent government decree has made the use of an automatic brake compulsory; hence the change.

The Illinois Central Passenger Station.

Work was begun on the new passenger station of the Illinois Central at Chicago last week. The piling is now being driven to depths of from 50 to 70 ft. Timber cribbing on the top of the piling will carry the masonry foundations, the bases of which will be from 18 to 30 ins. below the city datum. The entire structure will be carried on piers having pile foundations. As we have said before, the architect of the work is Mr. Bradford L. Gilbert, of New York. He has opened an office in Chicago, where he is represented by his superintendent, Mr. J. T. Gilbert.

The Hurontario Ship Railroad.

A meeting was recently held at Toronto of persons interested in this project, and a company was organized by electing the usual officers. The directors appointed Mr. Tully, of Toronto, Chief Engineer, and Mr. E. L. Corthell Associate Engineer. The company holds an ample charter and surveys have already been made which are sufficient to enable a quite accurate estimate to be made of the cost of the enterprise. The promoters believe that the work will be taken up soon.

Great Northern Testing Laboratory.

The Great Northern testing laboratory recently installed at the St. Paul shops is a complete and convenient one. A one-story stone building built last fall is occupied jointly by the brass foundry and the laboratory. This building is 48 x 68 ft. in dimensions, and is a few feet from the blacksmith shops. The part of the structure set apart for the laboratory is divided into three rooms, viz., chemist's office, chemical testing and physical testing rooms. The chemical department is equipped for all classes of tests. It is well lighted and ventilated, and is heated by steam. In addition to the chemical apparatus the room is supplied with air pressure, exhaust, gas, etc. The gas is produced in the laboratory by forcing air through gasoline and passing the gas thus obtained through a purifying chamber. In the physical department there are three machines made by Riehle Brothers. The large testing machine has a capacity of 200,000 lbs. and may be used for tensile tests of bars up to 2 in. square and to 6 ft. in length. For transverse tests it will take beams 18 in. square and 12 ft. in length. For crushing it is adapted to test cubes of stone or other material up to 6 in., and posts, etc., up to 4 ft. in length. The oil testing machine

is of a new design and may be run at different speeds up to 50 miles an hour. A standard M. C. B. brass in a yoke bears on the journal, and may be loaded in 500-lb. increments up to 20,000 lbs. The yoke in which the brass is placed has an arm on either side graduated to foot-pounds for measuring the friction; the arms being on both sides the axle, may be operated in either direction without interfering with the record. A counter for recording the number of revolutions is provided, and provision is made for inserting a thermometer in the brass. The yoke for holding the brass is so arranged that a journal box may be inserted and the journal lubricated with oil and waste from below; then, by using the attachment for end motion, the conditions of actual service are simulated as closely as possible. The spring-testing machine has been placed in the blacksmith shop, convenient to the spring furnaces, and is adapted to testing elliptic and spiral springs, including the largest locomotive springs made. It is a hydraulic machine, with capacity of 65,000 lbs., and by means of the ram forces the springs up against the platen of the weighing levers. Mr. P. H. Conradson, who has been in charge of the testing department for nearly a year, planned the laboratory, which has been constructed and installed under his direction. Mr. Albert A. Smith, formerly with the Chicago & Northwestern, is Assistant Chemist.

The Ferguson Oil Burner.

The Ferguson oil burner was first used in the shops of the Chicago, St. Paul & Kansas City in the spring furnace and tube welder. Lately it has been adopted by the Harris Forge & Rolling Mill Co., of Minneapolis, where oil has been substituted in place of coal for fuel. In the Northern Pacific shops at Brainerd, Minn., this burner is used in the tube welder, bolt, annealing and several small furnaces. It is to be applied to the scrap furnace at these shops and to the tube welder in the Wisconsin Central shops at Waukesha, Wis.

Great Northern Air Brake Equipment.

A portion of the motive power and rolling stock of the Great Northern is being equipped with the New York Air Brake Co.'s appliances. This company's driver brakes and train brake apparatus are to be applied to 57 consolidation engines now being built at the Brooks Locomotive Works, and all heavy engines passing through the shops receive the same equipment. New freight and miscellaneous cars all have the New York train brakes. The New York train signal is now being applied to 171 of the company's passenger cars.

New Freight Steamers for the Great Lakes.

The Erie & Western Transportation Co. (Anchor Line), which operates a fleet of 15 steamers on the Great Lakes, will issue \$1,500,000 in bonds, to be used in adding three large steamships to its fleet and in improving its terminals at Erie, Pa.

THE SCRAP HEAP.

Foreign Notes.

The Paris, Lyons & Mediterranean station in Paris is about to be enlarged at a cost of over half a million pounds sterling.

The weekly special trains from Paris to Rome, modeled in general on the plan of, and connecting with the "club trains" from London to Paris, have again been put in service. The trains leave Paris every Monday night, and are made up solely of parlor and sleeping cars with a dining car attached.

The Victorian Government state that they suspended the Railway Commissioners chiefly because the latter, though fully aware that the state lines were being worked at a great loss, denied the possibility of retrenching, and allowed the deficiency to increase through their extravagance and mismanagement.

Electric train lighting is being tried on the Werra railroad, in Hannover, Germany, several first and second-class cars having been fitted up for the purpose. The current is furnished by storage batteries of the Correns type, which are arranged in boxes underneath the cars. Each car has been furnished with one 12-candle power lamp and four 8-candle power lamps.

Spanish American Notes.

Surveys are now in progress for a second line of railroad between Santos and Sao Paulo, Brazil, to be operated by the Sao Paulo Railroad Co.

The tunnel on the railroad from La Calera to Cabildo, Chili, is nearly finished. This tunnel, 1,015 metres in length, was begun about two years ago.

The Argentine government is negotiating for the lease of the Andine Railroad to private parties. The National Railroad Board has reported favorably upon this project.

The output of the coal beds near Mendoza, Argentine, is fully equal to the expectations of the owners, and the railroads are carrying out their intention of using native instead of imported coal for their locomotives.

In spite of the revolutionary troubles in Venezuela construction work on the Gran Ferrocarril de Venezuela has proceeded almost without interruption and rails have been laid between Puerto Cabello and San Blas, as well as upon the branch line from Morro to Guayao. Traffic on the Puerto Cabello & Valencia Railroad for the last week of April yielded gross receipts amounting to \$6,530.

All the directors of the Companhia Geral de Estradas de Ferro do Brazil have been arrested, including the two English directors, Messrs. Mawson and Lynch. They have been refused a writ of *habeas corpus*. The Leopoldina Railroad, which was "absorbed" by the GERAL company, is apparently in a hopeless condition. According to a special report by Mr. Alex. McDonnell it must advance its rates 40 per cent. to cover all the interest on its bonds, exclusive of that accruing on the GERAL bonds, exclusive of that accruing on the GERAL bonds issued in exchange for Leopoldina shares. In order to increase its traffic several branch lines must also be built.

There has been considerable comment over the announcement that the Peruvian Corporation was about to lose some of its most valuable concessions, and amongst others the famous Cerro de Pasco silver mines. Agents from Peru have visited this country and England in an endeavor to secure bids for these concessions from capitalists, with which to influence the Peruvian Congress, at its session in July next, to take action antagonistic to the Peruvian Corporation. It turns out that these agents are not officials of the Peruvian government, but are working in the interest of private parties. The contract between the government and the corporation relative to the Cerro de Pasco mines has not proved satisfactory to either parties and a new contract is to be arranged at the coming session of congress. This fact may have given hope to some schemers that the Corporation could be ousted. As the commercial and industrial development of Peru, and her entire railroad system, depends upon the Corporation it is not likely that congress will listen to a project which would place the country again in bankruptcy.

World's Fair Notes.

Holland has offered to construct as an exhibit an exact reproduction of Henry Hudson's ship the "Half Moon."

The H. C. Frick Coke Co. will exhibit a working model of its entire plant. Machinery will be in operation, being run by electricity. Gas will be used for oven fires, and asbestos will represent coke.

The executive committee passed a resolution against any enlargement of machinery hall and manufactures building. They say that the space devoted to these two structures is ample to contain all the exhibits they may have.

The Pennsylvania board of World's Fair managers have made arrangements for a petroleum exhibit. An iron tank 300 ft. in diameter and 80 ft. high, covered with a glass dome, will contain the exhibit. All the processes which enter into the production of oil will be shown. Two or three wells 3,000 ft. deep will be bored outside the building.

The great Laird dockyard at Birkenhead, England, has agreed to furnish a good exhibit for the transportation section. The naval officer detailed to organize naval and shipping exhibits throughout Europe is shortly going to Glasgow to arrange for exhibits from the great ship-building industries of the Clyde. Some of the exhibits now at the naval exhibition at Liverpool have been promised for Chicago.

The Baltimore and Ohio railroad is having an elaborate display made for the Exposition. It includes models of rolling stock and motive power, also models showing construction of the first fourteen miles of road, which were opened for traffic May 24, 1827, from Baltimore to Ellicott Mills. It will show the "York" locomotive built by Phineas Davis. The "wagons" or coaches the "York" pulled, and which the horses pulled before it was constructed, will be represented by models on the strap iron track. There will also be models of the "Grasshopper" locomotive. The first regular passenger coaches, or models of them will also be exhibited.

Hours of Labor on English Railroads.

The Select Committee (Parliamentary) which is inquiring into the hours of labor of railroad servants received lately the evidence of Major Marindin, C. M. G., R. E., one of the inspecting officers of railroads for the Board of Trade. Since the date of his appointment he had held 429 inquiries himself, on train accidents, and during the years 1888, 1889, 1890 and 1891 there were held by the three inspecting officers 257 inquiries. During the last four years he had had on 23 occasions to call attention to the fact that the hours of work of some of the men were excessive. In addition to the accidents which he himself had called attention to, other inspecting officers had called attention on 24 occasions to the long hours of work, and upon 11 occasions they had reported that the servant held responsible for the accident, or partially so, had worked very long hours; upon nine occasions the accident had been attributed to some extent to these long hours of work. With regard to the practicability of legislation with reference to the hours of work of railroad servants, although he was very strongly of opinion that very long hours were an evil and must be put an end to somehow, he did not think that at present it was desirable to put any statutory limitation to their hours. Sir Henry G. Calcraft, K.C.B., Permanent Secretary to the Board of Trade, was examined by Sir Michael Hicks-Beach, and said he did not think it would be desirable to attempt to limit the hours of labor of railroad servants by law; if the Board of Trade undertook inquiries into allegations of overwork and reported to Parliament, with the moral power of public opinion and the fact that there might be legislation afterward if unreasonable hours were still maintained, he believed that would have the effect of bringing to reasonable limits the hours of labor.

The Minneapolis Convention.

In order to care for the Inter-urban business during the Republican National Convention, the electric railroad will run trains every two minutes between Minneapolis and St. Paul. The Great Northern and Chicago, Milwaukee & St. Paul will increase their train service to 32 trains for the former and 20 for the latter.

Additional tracks are being laid to accommodate the large number of special trains and cars, which will remain throughout the convention.

Railroad English.

A correspondent who has been nosing around among documents issued "for employees only," finds the following on the bulletin board at a certain terminal station in the cultured state of New York:

"All freights will not be run Monday, May 30.
"A. B., Supt."

The editors of the *Railroad Gazette* are painfully aware that their sermons on theoretical and applied science in the field of railroading often fail of their best results in consequence of the lack of an appropriate text. There is no sermon ripe just now but the above text is self-illustrative. The motive for turning such a verbal somersault will probably never be known, but the subject of the notice at once suggests the possibility that its writer was trying to avoid the mistake of the superintendent who several years ago announced that on a certain holiday all freight trains "will be discontinued" and who has never ordered them put on again. He has issued similar notices every year since. The trains did resume their trips after the holiday, every time, without any order to do so. Perhaps it is this persistence that leads the superintendent to reiterate his order. For "catching on," for understanding the business, and doing well in spite of careless superintendence, the American trainman still stands in the front rank.

Tunnel Blockades.

The Coosa Tunnel on the Columbus & Western, 25 miles east of Birmingham, Ala., was found to be on fire on May 22, and at last accounts the road was still impassable. The fire made rapid headway, burning several days, and it was found necessary to stop up the ends of the tunnel so as to smother the fire. The tunnel is timbered except for a short distance in the middle, and it is said that there is a vein of coal which probably helped to feed the fire. The burning of the timbers was followed by a cave-in near the east end, and the removal of the fallen earth seems to have required several days after the flames were sufficiently subdued to permit the work of clearing to be begun. The tunnel is half a mile long and was constructed about five years ago at a cost of about \$1,000,000.

On the night of May 30 the roof of tunnel No. 6 on the Pittsburgh, Cincinnati, Chicago & St. Louis near Steubenville, O., caved in, completely blockading the tracks for a day or more.

On May 31, while a large force of men were at work repairing the tunnel on the Lake Erie, Alliance & Southern, 12 miles south of Alliance, O., which caved in May 24, another large section fell without warning, burying Section Foreman Chapman and two laborers. Their injuries were probably fatal.

Old Timers.

A meeting of much more than ordinary interest took place at Major Pangborn's office yesterday. In his preparatory work for the Baltimore & Ohio exhibit at the World's Fair the Major is clearing up history upon a good many points which have long been obscure. . . . Christopher Smith, who lives on Maryland Heights, opposite Harper's Ferry, is the oldest living locomotive engineer on the continent. The next oldest is Joseph York, of Meadville, Pa. Samuel Doubleday is the oldest living employe of the Baltimore & Ohio, and Wm. Ijams the next oldest. Doubleday was the first finisher ever employed in a railroad shop in the country, and entered the Baltimore & Ohio service in 1830. Ijams was not long after him, and was the first blacksmith in the company's employ. Doubleday subsequently became Superintendent of the Winans shops and Ijams foreman of the Winans smith shop. The former is 82 and the latter 80 years of age, and both were at the laying of the cornerstone of the Baltimore & Ohio on the Fourth of July, 1828. Christopher Smith, who is over 80, began with the Baltimore & Ohio in 1831 as a driver, when there was no steam power on the road, and in 1833 was a fireman upon the "Traveller," the third locomotive placed upon the road, and a year later became the engineer of the "John Quincy Adams," one of the earliest of the grasshopper engines. York became a Baltimore & Ohio man in 1836, acting as a fireman upon one of the grasshoppers, and in a short time he was running her as engineer. The result of the interchange of memories and the combined recounting of the facts of 60 years ago was an important addition to railroad history. The old men, accompanied by Mr. Mendes Cohen, President of the American Society of Civil Engineers, who was an apprentice boy under Doubleday, went to the Merchants' Club, where Major Pangborn entertained them at lunch. Subsequently the party repaired to a photograph gallery, where several sittings were taken of the veterans, all of whom, if living next year, will be the Baltimore & Ohio's guests at the World's Columbian Exposition.—*Baltimore Sun*.

The Wheeling Electric System.

W. R. Kimball and A. V. Champion, of Cincinnati; L. K. Clymonds and W. W. Hazzard, of Cleveland, and A. M. Leyda and A. M. Jolly, of Beaver Falls, Pa., have purchased a controlling interest in the capital stock of the Wheeling Railway Co. and the Citizens' Railway Co., of Wheeling, W. Va., for \$900,000. The two lines have been operated jointly and comprise 20 miles of electric lines, connecting Wheeling with the suburbs of Benwood, Bellaire, Martin's Ferry, Etnaville and Bridgeport, and traversing the city of Wheeling over two parallel streets. For lack of capital the roads and equipment have depreciated, and the transfer was made to bring more capital into the system. The capital stock will be increased to \$250,000 and a complete Thomson-Houston system put in, including new cars and trolley wires. The track is to be relaid with heavier rails and the service generally improved. New boards of directors were elected for both companies. William R. Kimball was elected President of the Wheeling Railroad and John J. Jacobs President of the Citizens' line.

A Quick Run.

A special train from Cincinnati to Toledo over the Cincinnati, Hamilton & Dayton one day last week traversed the distance, 201 miles, in four hours and two minutes, which is a great deal faster than any trip over this road has ever been made before. The stops made were as follows: Troy, 4 minutes; Piqua, 2 minutes; Lima, 21 minutes for lunch; Deshler 2 minutes.

"Padding" the Mails.

President J. C. Newton, of the Des Moines & Kansas City Railroad, has been acquitted of the charge of conspiring to defraud the Government by "padding" the mails. He was arrested several months ago, and his trial was ended at Des Moines last week. Once every four years all the mails carried on railroads are weighed for a period of one month, and on the weight thus ascertained the rate of compensation to be paid the road for the four year period is based. At the time this weighing was done on the Des Moines & Kansas City it was found that large numbers of newspapers were sent and resent over the road in a way to indicate fictitious consignments. It would appear from this acquittal that the guilty man, if there was one, has not yet been caught, but the newspapers freely criticize the conduct of Mr. Newton who, they say, banqueted the jurymen who acquitted him. One dispatch says: "Judge Woolson reprimanded Newton, broadly intimating that if he had the power he would again put him on trial, and that if he had anticipated such conduct he would have set the verdict aside. He then dishonorably discharged the entire jury from any further connection with the Federal courts."

LOCOMOTIVE BUILDING.

The Brooks Locomotive Works has shipped 15 heavy freight engines to the Great Northern. They have eight drivers, a four-wheel leading truck, and have a weight on the drivers of 136,000 lbs. The works shipped on Saturday a heavy engine to the Silver City & Northern and another to the Ulster & Delaware.

Two of the new Vulcanian compound locomotives, Nos. 386 and 387, have been delivered to the Central of New Jersey, and are in service. The other two, Nos. 388 and 389, are expected daily, as the contract calls for their delivery before June 1. These locomotives are duplicates of No. 385, recently illustrated and described.

CAR BUILDING.

The Barney & Smith Mfg. Co., of Dayton, O., will soon take out a charter in Ohio as an incorporated company, the capital of which will be \$4,500,000. The organization of the new company will be completed this week.

The Chicago, Burlington & Quincy has contracted with the Pullman Co. to build 55 standard chair cars. The cars will be similar to those built this spring, and will have the Adams & Westlake No. 121½ lat.ps. The 45 coaches for this road to be built by Jackson & Sharp, Wilmington, Del., will also have the same lamps.

The Ensign Car Co., of Huntington, W. Va., has commenced work on 280 coal cars for the Chesapeake & Ohio. The cars are of a new model and are to be used for carrying coal to steam vessels. They will be very high and short, so that a number of them can be carried on the coaling docks at once. A part of the order is to be built with the Fox patent pressed steel truck.

BRIDGE BUILDING.

Alleghany County, Md.—The County Commissioners met in special session at Cumberland, last week, and awarded to the King Bridge Co. the contracts for erecting new highway bridges at Waterdiff, at Taun Creek and at Pack-Horse.

Alton, W. Va.—The county court of Harrison County, W. Va., has approved plans for building a new iron bridge at Alton, in that county. The cost is expected to be \$3,000.

Bethlehem, Pa.—The project of rebuilding the old Lehigh bridge at this place, which was started recently, is likely to prove successful. An award of \$26,000 will probably be given to the bridge company.

Burlington County, Pa.—The contract for a new bridge on the Georgetown Road, Burlington County, has been awarded to the Trenton Steel & Iron Works.

Cumberland, Md.—The new steel bridge, costing \$30,000, over Wills Creek at this place was formally opened last week. The bridge is a handsome structure. The West Virginia Central & Pittsburgh has awarded to the Pencoyd Bridge Co., of Philadelphia, the contract for building a new steel trestle to extend from the station at Cumberland to the Potomac River bridge, the contemplation of which was mentioned in the *Railroad Gazette* several weeks ago. The work is to be finished in four months.

Duluth, Minn.—The Duluth City Council has passed an ordinance giving the Duluth & Northeastern railroad authority to construct a bridge across the harbor from the foot of Fifth avenue to Minnesota Point. A draw in the bridge will be about 1,000 ft. from the harbor end of the canal. The erection of the bridge will be opposed by the Marine interests.

Framingham, Mass.—Dean & Westbrook, New York, have been awarded the contract for the iron work for the new bridge on Easton avenue, over Sudbury River, by the Framingham selectmen. The contract price is \$3,200.

Little Falls, N. Y.—The south arch of the Ann street stone bridge over the Mohawk River collapsed last week and will probably be replaced by an iron bridge. The old structure was built in 1832. The new bridge will be 185 ft. long and will cost about \$10,000. Another estimate gives the expense at \$25,000, and if that is found to be more correct, an attempt will be made to rebuild the stone arch.

Minneapolis, Minn.—The Edge Moor Bridge Works have erected one set of girders and one span of the Great Northern Bridge across the west channel of the Mississippi River.

Moorefield, W. Va.—It is reported that the Youngstown Bridge Co. has contracted to build a bridge over the South branch of the Potomac River at "Buzzard's Ford," Hardy County, near Moorefield. The bridge is to be of three spans, 150 ft. each. The material for it will have to be hauled 27 miles over very bad roads.

Mount Vernon, Wash.—The county commissioners have ordered Engineer Stixrud to draw new plans for the bridge across the Skagit River at Mount Vernon. The plans drawn about a month ago were not accepted by the United States government. The bridge will be completed by Nov. 1. The draw is to be 283½ ft. long and there will be two spans of 150 ft. and 140 ft. each, besides the approaches.

Parkersburg, W. Va.—The Baltimore & Ohio has completed a new steel overhead structure over Julien street, in Parkersburg, at the approach to the Ohio River bridge. The bridging of Ann street was completed several weeks ago.

Pittsburgh, Pa.—The wooden superstructure of eight or nine small bridges of the Allegheny Valley road, whose spans average 60 ft., will be removed and replaced by iron.

Pompton, N. J.—The New York, Susquehanna & Western has let contracts to build 11 new iron bridges to the Edge Moor Iron Works, of Wilmington, Del. They will be located at points between Pompton, N. J., and Stroudsburg, Pa.

Roswell, Ga.—A mass meeting to consider the proposition to build a free bridge across the Chattahoochee River was held at Roswell, Cobb County, last week. It was decided to appoint a joint committee from Fulton, Milton and Cobb counties to confer with the County Commissioners and ask for appropriations to build the proposed bridge.

Toledo, O.—The engineers of the Lake Shore & Michigan Southern last week began an inspection of all its steel, iron and wooden bridges between Buffalo and Chicago. All classes of bridges along the company's tracks will be carefully inspected.

Tonawanda, N. Y.—The new bridge on the branch of the New York Central, over Tonawanda Creek, will be 500 ft. long in five spans.

MEETINGS AND ANNOUNCEMENTS.**Dividends.**

Dividends on the capital stocks of railroad companies have been declared as follows: *Cleveland, Cincinnati, Chicago & St. Louis*, quarterly, 1½ per cent on the preferred stock, payable July 1. *Delaware & Hudson Canal*, quarterly, 1½ per cent., payable June 15.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Chicago, Burlington & Northern, annual, La Crosse, Wis., June 8.
Chicago, St. Paul, Minneapolis & Omaha, annual, Hudson, Wis., June 4.
Fort Worth & Trinity Valley, annual, Fort Worth, Tex., June 25.
Hudson Supt. Bridge & New England, annual, New York, N. Y., June 6.
International & Great Northern, special, Palestine, Tex., July 14.
Milwaukee, Lake Shore & Western, annual, Milwaukee, Wis., June 3.
Minneapolis, St. Paul & Sault Ste. Marie, annual, Minneapolis, Minn., June 7.
Minnesota Transfer, annual, St. Paul, Minn., June 8.
New York & New England, annual adjourned, Boston, Mass., May 31.
New York & South Beach, annual, New York, N. Y., June 7.
Oregon Railway & Navigation Co., annual, Portland, Ore., June 20.
Puduch, Tennessee & Alabama, special, Puduch, Ky., June 15.
Portsmouth, Great Falls & Conway, annual, Portsmouth, N. H., June 6.
St. Joseph & Grand Island, annual, Elwood, Kan., June 14.
St. Louis, Alton & Terre Haute, annual, St. Louis, Mo., June 6.
St. Paul & Sioux City, annual, St. Paul, Minn., June 4.
Superior Short Pine, annual, St. Paul, Minn., June 6.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Institute of Electrical Engineers* will hold its next annual meeting at the Grand Pacific Hotel, Chicago, Ill., June 6, 7 and 8.
The *American Society of Civil Engineers* will hold its next annual convention at the Hygeia Hotel, Old Point Comfort, Va., June 8.
The *Railroad Telegraph Superintendents' Association* will hold its annual convention at Denver, Col., June 15 and 16. P. W. Drew, 335 Sixty-seventh street, Englewood, Ill., is Secretary of the association.
The *Master Car Builders' Association* will hold its annual convention at Congress Hall, Saratoga Springs, N. Y., June 15.
The *American Railway Master Mechanics' Association* will hold its annual convention at Congress Hall, Saratoga Springs, June 20.
The *American Association of General Baggage Agents* will hold its next annual meeting at Mackinac Island, Mich., July 20.
The *New England Railroad Club* holds regular meetings, at the United States Hotel, Beach street, Boston, Mass., on the second Monday of each alternate month, commencing January.
The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.
The *New York Railroad Club* holds regular meetings on the third Thursday in each month, at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, N. Y.
The *Southern Railway Club* holds regular meetings on the third Thursday of the months of January, February, March, May, September and November at such points as are selected at each meeting.
The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November. By special resolution the next meeting will be held in April.
The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.
The *Northwestern Truck and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.
The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.
The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m., on the third Wednesday in each month.
The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.
The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.
The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month. The annual meeting is held on the third Saturday in January. The club stands adjourned during the months of July, August and September.
The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.
The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.
The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.
The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.
The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.
The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.
The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.
The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.
The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.
The *American Society of Swedish Engineers* holds

meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o'clock p. m. on the first Friday of each month.

The *Tacoma Society of Civil Engineers and Architects* holds regular meetings on the third Friday of each month, in its rooms, 201 and 202 Washington Building, Tacoma, Wash.

The *Engineers and Architects' Club of Louisville* holds regular meetings on the second Thursday of each month, at 8 o'clock p. m., at its rooms in the Norton Building, Louisville, Ky.

The *Association of Engineers of Virginia* holds regular meetings at Roanoke, on the second Saturday in each month, at 8 p. m., except the months of July and August.

American Society of Civil Engineers.

Extracts from the "Bulletin" of May 26, 1892.—On Wednesday, June 1, a meeting will be held at the Society House, at 20 o'clock. The papers for the evening will be on "Wind Bracing in High Buildings," by Henry H. Quimby, M. Am. Soc. C. E., and "A New Formula for the Strength of Columns," by A. J. Du Bois, Jun. Am. Soc. C. E. After the meeting the usual collation provided by special subscription of resident members will be served. The paper by Professor Du Bois gives a formula which is claimed to be more accurate and to possess a wider scope than those in common use. It is based upon the length and cross-section of the column, its physical characteristics, and the end conditions. The discussion is theoretical, and results in the establishment of three formulas, respectively for long, intermediate and short columns. The first and third when plotted give curves, and the second a straight line. The constants in these are: the breaking unit stress in the outer fibre from compression, the modulus of elasticity, and one depending on the end conditions. The remainder of the paper is taken up by a comparison of results from well known experiments with those given by the formulas.

May 4. At the meeting held this night papers were read as announced. The paper on "Tunnel Alignment" was discussed by R. B. Stanton, M. Am. Soc. C. E., who mentioned one of the difficulties in alignment which arose from a bulging upward of the bottom. O. F. Nichols, M. Am. Soc. C. E., spoke of the desirability of a better light for such work than the old oil lamp. He described the work of aligning a Peruvian tunnel, which was done principally by miners on account of illness of the engineer. The headings met within two or three feet. He criticised the great amount of instrumental work done, as he considered the refinements often unnecessary, and mentioned rough methods used to guide the workmen. J. F. O'Rourke, M. Am. Soc. C. E., described the method adopted in the Haverstraw tunnel, using reference plugs in the roof for both line and grade. J. Foster Crowell, M. Am. Soc. C. E., approved of keeping the line of sight of the level and transit out of reach of the work, and mentioned the use of a diamond drill for testing the position of the centre line from the surface above; a string being stretched taut through the whole, and its departure from a vertical calculated. A. McC. Parker described the transfer of a line down an inclined shaft, the axis of which was twisted during its excavation. The Secretary called attention to the wide range of usefulness of templates (as mentioned in the paper) for locating accurately, bearing stones, etc., without the use of level or transit, so that the presence of an engineer is not required.

May 18.—The paper on "Hot Tests for Determining Change of Volume in Portland Cement," by W. W. Maclay, M. Am. Soc. C. E., was read and was discussed at considerable length by Mr. Robert W. Leslie and J. J. R. Croes, M. Am. Soc. C. E.

ABSTRACTS OF PAPERS TO BE READ AT THE CONVENTION.

The Black Eagle Falls Dam, Great Falls, Montana, by Maurice S. Parker, M. Am. Soc. C. E.—The author presents a small map, a fac-simile of that made in 1805 by the explorers Lewis and Clarke to accompany their report, which shows the Missouri River at the Falls. From the first rapid to the foot of the Falls, a distance of 10 miles, the descent is 412½ ft., and 75½ ft. of this is "sheer drop" at the Great Falls. The minimum flow of the stream is 4,000 cu. ft. per second, except when the flow is affected by "anchor ice dams," which are described by the author. The dam described in the paper is built just above the Black Eagle Falls and gives 40 ft. head of water for power. It was completed in 1891, and full details of bids for doing the work (all of which were rejected) and the dam built by day's work, cost of labor and methods of construction, are given. The dam is built of timber cribs filled with stone partly laid in cement, and the chief difficulty to be overcome was the rapid current, due to a fall of about 2 ft. per hundred at the site. The cost of construction is given in detail, the total cost being \$175,000. Assuming 3,360 cu. ft. as the minimum flow, there would be available 12,287 H. P., and the cost would therefore be \$13.19 per horse power.

Hardening Structural Steel, by A. C. Cunningham, M. Am. Soc. C. E.—The author states that the upsetting, hammering and partial heating of the bar leave the steel in an uncertain condition as to internal stress. This can only be removed by thorough annealing. Two tables of tests of specimens from bars, one annealed and the other not, are given, which show the improvement caused by annealing, in stretch, reduction of area at point of fracture, and appearance of fracture. In full sized bars there is a loss of ultimate strength of 2,000 to 6,000 lbs. per sq. in. from annealing, which if not allowed for in the specifications is an annoyance to both engineers and manufacturers. Tables are also given of tests of bars heated to a cherry red heat, and variously quenched in water, fish oil, soap and water, and boiling water.

The Results Obtained from Tests of Full Sized Steel Eyebars, by Frederick H. Lewis, Esq.—The author found differences as great as 5,000 to 10,000 lbs. per sq. in. between the tested strength of full sized steel eye-bars and of small specimen tests of the same material, together with a notable decrease in the full sized bars in elastic limit. The author comments on the irregularities in the tests for elastic limit, which make it impossible to put

them in a line or curve. He shows, however, that large losses occur generally in bars giving high specimen tests, but that bars of 60,000 to 64,000 lbs. ultimate strength show average losses of only 765 lbs. per sq. in. Other interesting comparisons are made. His conclusions are, first, that we have only to use steel with low tensile strength and the large losses will disappear. Second, that tests which give high figures in specimen tests are less reliable than those which give low ones, and do not represent the mean value of the material. Engineers are deceived by these high values and no doubt the real quality of any material is shown by the mean results.

Emergencies on Railroad by Channing M. Bolton, M. Am. Soc. C. E.—This paper is confined to three topics: First, the removal of a wreck on an ordinary cut or fill when the track is obstructed. Second, the removal of a wreck occasioned by the fall of a bridge. Third, a list of tools, material and other things which every railroad company should have at a convenient point on the line, ready for use when emergencies arise. The paper deals with the arrangement and disposition of the repairing forces, the proper methods of removing wreckage, and of erecting false-work or trestles for temporary track where it is needed.

Experiments on Iron and Steel Joints Riveted on an Angle, by Bertram B. Flint, Esq.—This paper details the results of certain experiments made on lattice bars of various dimensions, riveted in various ways to a 6 x ¾ in. iron plate. The breaking load varied between the limits of 45,800 to 55,000 lbs. per sq. in. of net section. In some cases the rivets sheared, in others the plate broke between rivet holes. The specimens with reamed holes were in general the stronger. The strength per square inch of the lattice increased as the angle made by the line of rivets with the bar increased. The strength of the joint as a whole for the same number of rivets was but little affected by the position of the holes.

Rainfall, Flow of Streams and Storage, by Desmond Fitzgerald, M. Am. Soc. C. E.—This paper is founded on, and descriptive of, 15 tables which were prepared for the purpose of calculating the yield of drainage areas which have varying proportions of land and water surface.

Uniform Practice in Pile Driving. By J. Foster Crowell, M. Am. Soc. C. E.—Mr. Crowell refers to the authors who have given the formulas now best known as to the bearing power of piles, and gives a diagram illustrating the variation in a particular case of the results given by sixteen formulas both as to extreme sustaining power and permissible load. These variations arise from the different methods of treating the problem. Some authors take into consideration the compressibility and weight of pile, others neglect one or both. It is not considered worth while to refine a result beyond the refinement of the data.

The Cantilever Highway Bridge at Cincinnati, by Gustave Kaufman, M. Am. Soc. C. E., and *The Cantilever Span of the Dam,* by F. C. Osborn, M. Am. Soc. C. E.—This bridge was built during 1890 and 1891. Its total length is 2,966 ft., and the main cantilever span is 520 ft. between centres of piers. The roadway is 24 ft. wide, and there are two sidewalks, each of 7 ft. width. The channel span has a clear height of 100 ft. above low water and 40 ft. above high water.

Bridging Canons Lengthwise. By Howard V. Hincley, M. Am. Soc. C. E.—This is a description of the peculiar features of two bridges. The first is in the Apache Canon of the Rio Galisteo, on the main line of the N. M. & S. P. R. R., and sections and plan of the river crossings are given, also a plan and elevation of the bridge. The centre line is on a 10-degree curve, and is 14½ in. off the centre line of the bridge at the ends and centre. The second case is in the Royal Gorge of the Arkansas River, and is known as the "hanging bridge." A view and end elevation are given. The great peculiarity is the suspension of one of the trusses from the intersections of pairs of inclined beams, which rise from abutments against the rocks on opposite sides of the canon to the point of intersection, where they abut against each other.

Association of American Railway Accounting Officers.

The annual meeting of this association was held in Chicago last week, about 200 members being present. Mr. D. A. Waterman, of the Michigan Central, has been chosen President for the ensuing year and Mr. G. W. Booth, of the Baltimore & Ohio, Vice-President.

Engineers' Club of Cincinnati.

At the May meeting of the club three new members were elected, and one application for membership was received.

In place of the usual paper on some engineering topic, Mr. E. J. Carpenter, of the United States Engineer Corps, entertained the members and ladies with a lecture, illustrated with lantern pictures, on the subject, "Photography as an aid to Engineering." The lecture dealt principally with the work performed by the dredging fleet on the Ohio River, of which Mr. Carpenter is in charge. The remainder of the evening was devoted to a light repast and to general sociability, and the whole proved an agreeable diversion from the usual programme.

The June meeting will be taken up with a discussion of a new water supply for the city of Cincinnati.

The Engineers' Club of Philadelphia.

At the business meeting, May 21, 1892, Mr. James Christie, President, was in the chair and about 30 persons were present.

The Secretary read the following communication from the Board of Directors: "Regretting the necessity for the action, we respectfully recommend the acceptance of Mr. Trautwine's resignation of the secretaryship." On motion of Mr. Henry G. Morris, the resignation was accepted.

The following gentlemen were elected members: Active, Messrs. Edward H. Jenkins, B. Antrim Haldeman, William G. Hartranft and Clement B. Webster; Associate, Mr. J. Walter Douglas.

The Secretary read a description of blue prints submitted by Mr. C. S. Sims, Jr., and exhibited descriptive designs for an Aerial Watch-box for Railroads.

Mr. Telle Henry Muller read a paper upon "Evaporation by Multiple Effect." The paper was illustrated by a number of blue prints, representing different forms of multiple-effect evaporators and was discussed by several members.

PERSONAL.

—Mr. John J. Byrne, Assistant Passenger Traffic Manager of the Atchison, Topeka & Santa Fe, expects to start for Australia about June 8.

—Mr. Samuel Rea, recently appointed assistant to the President of the Pennsylvania, sailed for Europe last

week, and will assume his new duties immediately on his return.

—Mr. H. Walter Webb, Third Vice-President of the New York Central, sailed for Europe this week. He will be absent three or four weeks, and his vacation will be devoted entirely to rest.

—Mr. George Wightman Vaillant, son of George H. Vaillant, Second Vice-President of the Erie Lines, was graduated at the Massachusetts Institute of Technology this week, receiving the degree of the Institute.

—Mr. Samuel Spencer, of the firm of Drexel, Morgan & Co., this week began a tour of inspection over the Richmond Terminal system. He is accompanied by President W. G. Oakman, and a thorough examination will be made of the properties, taking a week or 10 days.

—Col. James L. Morrow, General Superintendent of the Brooklyn & Brighton Beach Railroad, died at his home in Brooklyn, last week, of consumption. He was formerly a Division Superintendent on the Chesapeake & Ohio. He was born in the South and had been a colonel in the Confederate Army.

—Mr. Jan K. Trnovsky, engineer of the Austrian Northern Railroad Co., is in America to study American railroads and railroad methods. He lately visited the Baltimore & Ohio shops at Mount Clare, the Steel Works at Steelton, the Columbian Iron Works and the other shipyards at Baltimore.

—Mr. V. E. McBee, formerly General Superintendent of the Central of Georgia, is now in the service of the Richmond & Danville, but has not yet been assigned to any position, says a Savannah paper. When Mr. McBee resigned it was reported that he would come north, but this seems to be unfounded.

—Major S. B. Wathen, who has been recently appointed resident engineer of the Texas & Pacific, to succeed Mr. Allen, has been connected with railroads in Texas for the last 25 years. He has been in the service of the International & Great Northern, the Texas & Pacific before this, and the Missouri, Kansas & Texas, and has located several lines in the state.

—Mr. T. P. Bellows, who has been Superintendent of the Illinois Central at New Orleans, has been transferred and has been succeeded as Division Superintendent by Mr. J. W. Higgins, who has been in the Illinois Central's service for 17 years, most of the time on the northern divisions. He has been Acting Assistant Superintendent and Master of Trains on the Louisiana division since Jan. 1.

—Mr. G. H. Thomson, Bridge Engineer of the New York Central & Hudson River, was injured in a railroad accident Monday, May 23. He was riding in the inspection engine of the General Roadmaster, Mr. Otis, together with Mr. Otis and several employees of the road. The inspection engine collided with an engine backing up the main line. Mr. Thomson's right arm was broken above the elbow, his ankle was sprained, and he was otherwise cut and bruised. Mr. Otis was also somewhat scratched, but not seriously injured.

—Mr. Thomas Urquhart, who has been 24 years in the Russian railroad service has accepted the position of General Manager of the Nevsky Engineering Works at St. Petersburg. The works build steamships, marine engines and locomotives, and employ about 2,000 men. They have also a small open-hearth steel plant and rolling mills. Mr. Urquhart is well known to readers of the *Railroad Gazette* from his writings, particularly on the use of oil fuel for locomotives, which he successfully introduced on the Grazi-Tsaritsin railroad. He has also introduced there the use of compound locomotives, concerning which he has written to the *Railroad Gazette* within the last year.

—Mr. John E. Henry, who died at Des Moines, Ia., early last month, was formerly a well known Western contractor and railroad officer. In early life he was an engineer in the office of John B. Jervis, and was engaged on the enlargement of the Erie Canal and other works. In 1848 he was with Mr. Jervis as a civil engineer on the construction of the Hudson River Railroad. He moved to the West in 1851, and was Superintendent for the contractors of the Chicago & Rock Island, of which he was for a time also Superintendent. Mr. Henry also had charge for the contractors of the construction of the Mississippi & Missouri road from Davenport to Iowa City, and of a considerable section of the Union Pacific. After this he was Receiver successively of the Des Moines Valley, Keokuk & Des Moines, Des Moines & Fort Dodge, and Davenport & St. Paul roads. He had resided in Des Moines since 1885, but had not been engaged in active work since that time. Mr. Henry was about 73 years old at the time of his death.

—Mr. C. H. Platt, General Manager of the "Harlem line" of the New York Central, has been appointed General Superintendent of the New York, New Haven & Hartford road. Mr. Platt was born at Stepany, Conn., May 30, 1850, and was the son of Allen Platt, for many years Station Agent of the Housatonic at that place. He first began railroad work as clerk in his father's office and in 1868 succeeded him as Agent. In 1872 he was appointed General Freight and Passenger Agent of the Shepaug road, holding that office until Jan. 1, 1874, when he became Superintendent of the same road. In January, 1881, he was appointed Superintendent of Construction of the New York & New England, in charge of completing the line between Waterbury and the Hudson River. In February, 1882, he was made Terminal Agent of the New York & New England road at Fishkill; in 1884, Superintendent of the Western Division of the same road and in 1889 General Manager of the Harlem line, which includes the operation of the Grand Central Station in New York. The office of General Superintendent on the New York, New Haven & Hartford has been vacant for several years.

ELECTIONS AND APPOINTMENTS.

Barre.—The following directors elected at the annual meeting of stockholders at Barre, Vt., May 26: W. A. Stowell, Montpelier, Vt.; A. I. Morse, E. L. Smith, John Trow and F. W. Stayan, Barre, Vt. The directors elected A. D. Morse, President; W. A. Stowell, Vice-President and Managing Director, and F. W. Stayan, Clerk and Treasurer and General Superintendent.

Baltimore & Potomac.—The annual meeting of the stockholders of the road was held June 1. Ex-Governor Oden Bowie, who has been President for many years, was re-elected. The Directors elected are Frank L. Thomson, B. F. Newcomer, William T. Walters, H. D. Barclay, Samuel Cox, Jr., Francis T. Smith and John Cassels.

Brainerd & Northern Minnesota.—The following officers have been elected: President, John S. Pillsbury; Vice-President, George A. Pillsbury; Second Vice-President and General Manager, Ray W. Jones; Secretary, J. E. Glass; Treasurer, W. B. Ransom, and Chief Engineer, D. Forneri. The principal office is at Minneapolis.

Central of Georgia.—S. H. Hardwick, General Passenger Agent, has tendered his resignation. W. A. Winburn, now Chief Clerk in the Traffic Manager's office at Savannah, will succeed Mr. Hardwick.

Central Vermont.—George W. Kenney, of White River Junction, Vt., has been appointed Master Mechanic of the Rutland division, with headquarters at Rutland, Vt.

Chicago, Milwaukee & St. Paul.—H. E. Pierpont has been appointed Division Freight and Passenger Agent at Winona, Minn., to succeed J. T. Conley, assigned to other duties.

Chicago, Peoria & Southwestern.—The incorporators of the company in Illinois are: James R. Lane, Canute R. Matson, Christopher O. Closters and Samuel M. Rowe, of Chicago, and Lucius Clark, of Marseilles, Ill.

Chicago Rock Island & Pacific.—The stockholders of the railroad at their annual meeting in Chicago, June 1, re-elected the following named Directors: R. P. Flower, Benjamin Brewster and Henry M. Flagler, New York, and George G. Wright, of Des Moines. The Directors elected officers for the coming year as follows: R. R. Cable, President; Benjamin Brewster, First Vice-President; W. G. Purdy, Second Vice-President, Treasurer and Secretary; H. A. Parker, Third Vice-President.

W. E. Dauchy, formerly Superintendent of the Paducah, Tennessee & Alabama road, has been appointed Assistant Superintendent of Maintenance and Construction of the lines west of the Missouri River, with headquarters at Topeka, Kan.

Chicago & Southeastern (Indiana).—J. W. Roberts, for 25 years Master Mechanic of the "Bee Line," has been appointed Master Mechanic of this road, formerly the Indiana Midland.

Denver, Texas & Ft. Worth.—The following directors were elected at the annual meeting in Denver last week: Frederick L. Ames, E. F. Atkins, Samuel Carr, F. G. Dexter, G. M. Dodge, John Evans, Morgan Jones, G. M. Lane and O. W. Mink. The attorney of the Union Pacific voted 200,000 shares for this ticket. About 8,000 shares, held by local stockholders, were voted in opposition to various measures.

Elizabethtown & Austin Springs.—The incorporators of the company in Tennessee are A. T. Cook, P. F. Logan, C. P. Toneray, I. N. Shoolbred, and S. F. Goodykountz.

Goshen Lateral.—The officers of this company are as follows: President, F. E. C. Hawks; Vice-President, Frank B. Defrees; Secretary, H. R. Whitmer; Treasurer, E. W. Hawks, and Engineer, C. R. Kinney, all of Goshen, Ind.

Great Northern.—General Manager Seargeant announces that after June 1 E. P. Hannaford, Chief Engineer at Montreal, will have charge of the Middle Division, with J. G. Macklin as assistant. J. Hobson, Chief Engineer of the Great Western Division, will take charge of the Northern & Northwestern Division, with H. Holgate as assistant.

Harriman Coal & Iron Railroad.—G. F. Simpson has been placed in charge of the engineering work on this railroad, with headquarters at Harriman, Tenn. He succeeds J. P. Suverkrop, who will hereafter give his entire time to his duties as Chief Engineer of the East Tennessee Land Co.

Hoxie & Pocahontas.—The company has been organized by the election of the following officers: William D. Gentry, President, 100 Washington Street, Chicago, Ill.; Joseph H. Moran, Vice-President and General Superintendent, Walnut Ridge, Ark., and R. D. Moran, Secretary and Treasurer, Hoxie, Ark.

Illinois Central.—T. P. Bellows, Division Superintendent at New Orleans, has been transferred, and the present Master of Trains, J. W. Higgins, has been promoted to his place. T. S. Evans, who has been Superintendent of Tracks and Trains on the Yazoo & Mississippi Valley Division, has been appointed Train Master, with headquarters at McComb, Miss. W. A. Baldwin has been named to succeed Mr. Evans on the Yazoo & Mississippi Valley Division.

Keokuk & Des Moines.—At the annual meeting of the company the following directors were elected for three years: R. R. Cable, H. Riddle and W. G. Fisher. The last named is the only new director.

Keystone Northern.—The following are the directors of this company recently chartered in Pennsylvania: F. L. Stephenson, Allegheny, Pa., President; J. M. Porter, Allegheny; Charles E. Speer, Geo. J. Whitney, Charles Donnelly, and John Wilson, Pittsburgh, and H. W. Biddle, Philadelphia.

Kickapoo Valley & Northern.—The following are the directors: Edward I. Kidd, of Prairie du Chien, Wis., Vice-President; W. S. Manning, of Muscoda, Wis., Secretary; Atley Peterson, Soldiers Grove; B. F. Washburn, Excelsior; Capt. W. H. Bennett, Madison, Wis.

Lehigh Valley.—Rollin H. Wilbur has been elected a director to succeed the late Ario Pardee.

Little Falls & Dolgeville.—The following are now the officers of this company: President, Carl Amann, 52 Wall street, New York; Secretary and Treasurer, E. R. Wauckel, 122 East Thirteenth street, New York, and Superintendent, Charles R. Eastman, Little Falls, N. Y.

Manchester & Lawrence.—The following directors were elected at the recent annual meeting: Charles A. Sinclair, Portsmouth, N. H.; George R. Chandler, Herman F. Straw, both of Concord; John W. Sanborn, Wakefield; George W. Armstrong, Brookline, Mass.; Elisha R. Brown, Dover; William P. Fowler, Boston. The directors organized with Charles A. Sinclair, President, and Charles B. Gafney, Clerk.

New York, Chicago & St. Louis.—G. T. Williams, Superintendent of Telegraph, has resigned, and J. S. Evans, of Fort Wayne, Ind., has been appointed his successor. Mr. Evans was formerly Train Dispatcher at Fort Wayne.

Newport News & Mississippi Valley.—A. T. Sabin has been appointed Chief Assistant Engineer of the Western Division. Epes Handolph is now Chief Engineer, having been transferred from the Eastern Division when the Chesapeake & Ohio assumed control.

Niagara Junction.—The first directors of this company are: Edward D. Adams, George S. Bowdoin, Charles F. Clark, Charles Lanier, Joseph Laroque, D. O. Mills, William B. Rankin, Francis Lynde Stetson, Frederick W. Whitridge and Edward A. Wickes, of New York City, and Charles A. Sweet, of Buffalo.

Northern (N. H.).—The annual meeting was held at Concord, N. H., May 25. The following directors were elected: Alva W. Sulloway, of Franklin; George E. Todd, of Concord; Silas Peirce, Benjamin P. Cheney, Uriel H. Crocker and J. H. Benton, Jr., of Boston, and Dexter Richards, of Newport.

Paducah, Tennessee & Alabama.—W. J. Hills has been appointed Superintendent of this company, vice W. E. Dauchy, resigned.

Phillips & Rangeley.—George Phillips has been appointed Superintendent, with office at Phillips, Me. He will have charge of the motive power, maintenance of way and car departments and train service.

Pittsburgh, Lake Erie & Chicago.—The following Directors of this new company were recently elected: John McKelvey, H. C. Huntington, Clarke Rude and Charles A. Judson, of Sandusky, O.

Port Townsend Southern.—At the annual meeting for the election of five directors the following were chosen: C. S. Smith, A. F. Burleigh, Thomas F. Bush, Charles Eisenbeis and Thomas Jackman.

Pueblo, Gunnison & Pacific.—The stockholders held a meeting in Pueblo, Col., May 25, and elected the following directors: M. D. Thatcher, J. B. Orman, George Bell, J. N. Carlie, Robert Gibson, William Crook, F. M. Dunbaugh, Charles Henkel and R. F. Westbrec.

Roland Park Elevated (Baltimore).—The reorganization of the company was completed last week by the election of Samuel M. Jarvis, President, Roland P. Conkling, Treasurer, and E. H. Bouton, Secretary. In addition to these officers, the board of directors consists of E. L. Sheldon, Charles O'Donnell Lee, Alfred Gregory and B. M. Beardsley. The control of the road is now held by the Jarvis-Conkling Investment Co., of Kansas City.

San Francisco & Salt Lake.—The company has been incorporated in San Francisco by Alvin Hayward, Daniel Myer, William Babcock, E. L. Steele, and E. F. Preston.

Texas & Pacific.—S. B. Wathen has been appointed Resident Engineer with headquarters at Dallas, Tex., vice W. B. Allen, resigned. The Resident Engineer will have charge of bridges, buildings, water service and engineering departments.

Wekiva, Bronson & Northwestern.—The following are the officers of the Suwannee River Phosphate Co., which is building this road: President, M. Harroldson; Secretary, W. I. Zachey; Treasurer, J. H. Porter, and General Superintendent, Charles P. Turner, Bronson, Fla.

Wheeling Bridge & Terminal Company.—A. H. Olmsted, of Hartford, Conn., has been chosen Vice-President of this company to succeed J. Kennedy Tod, of New York. Mr. Olmsted's name was printed incorrectly in these columns last week.

RAILROAD CONSTRUCTION. Incorporations, Surveys, Etc.

Baltimore & Harrisburg.—A contract was let last week to Wright & Langhorne, of Richmond, Va., for building the branch from Porters northeast to York, Pa., a distance of 15 miles. The new line is to extend through the southern part of York County, passing through the towns of Spring Grove and Thomasville. It is intended to ultimately extend the line from York east to the Susquehanna River at a point opposite Chickies, where connection will be made with the Columbia branch of the Philadelphia & Reading. Work is to begin on the line at once, and as it will be an easy road to build, it is expected that it will be completed early in the summer.

Baltimore & Ohio.—Contracts have been let for removing 12 trestles on the Wheeling branch between Gastonville and Washington, Pa., a distance of about 20 miles, and the ravines and valleys which they span will be filled in. When this work is completed there will be but two trestles on the branch and these are across valleys so deep and wide that it would be impracticable to fill them.

Brainerd & Northern Minnesota.—This railroad, chartered in Minnesota early in May, is to be built by the Northern Mill Co., of Minneapolis. The road is to start at Brainerd, and extend northwesterly toward Park Rapids, Minn. It will be about 25 miles long, extending through townships 134 and 135 in range 28, and 135 in ranges 29 and 30. The surveys were commenced May 1. The route is through a comparatively level country, and there will be no very difficult grades. A combination wood and iron bridge will be built over the Mississippi River at Brainerd. The capital stock has all been paid in, and a bonus of \$100,000 in bonds has been issued by Crow Wing County, of which Brainerd is the county seat. Ray W. Jones, of Minneapolis, is General Manager.

Buckingham.—C. D. Langhorne, of Richmond, Va., has the contract to build this road for the Rosney Iron Co. The line is to extend from Arvon, on a short branch of the Chesapeake & Ohio, south of the James River, through Buckingham County to Rosney, a distance of about 16 miles. The work will be light and the construction of the line will begin immediately.

Burlington & Missouri River.—It is reported that additional contracts have been recently let for continuing the extension of the line now being built northwest of Gillette, from a point near Powder River to Sheridan, Wyo., in the northwestern part of the state. It is also reported that the grading will begin beyond the Powder River this month, and that the line will be completed to Sheridan in October. The line has been graded from Gillette to Powder River, a distance of 40 miles, and about 10 miles of track has been laid. But for the bad weather the line would have been in operation to the river before July 1. About midway on the extension to Sheridan a branch of 50 miles in length will be constructed in a southwesterly direction to Buffalo. Right of way for this branch has been secured along Clear Creek.

Caminal & English Centre.—The company has a small force of men at work on the line near Caminal, Pa.,

and it is expected to have the track laid seven miles from that point during July. The line is being built from a connection with the Fall Brook Coal Co.'s road at Caminal northeast through a rich timber section to English Center in Lycoming County.

Chicago, Peoria & Southwestern.—The charter of this company was filed in Illinois by Samuel M. Rowe, of Chicago, and others, last week. It is proposed to construct a road from Chicago southwest to Peoria, extending through the counties of Cook, Dupage, Will, Kendall, La Salle, Putnam, Marshall, Tazewell and Peoria. The capital stock is \$5,000,000. The incorporators are local men and expect to secure township bonds sufficient to raise most of the money needed. Some aid has already been pledged.

Cleveland, Cincinnati, Chicago & St. Louis.—The special election held in Wayne and Boston townships, Ind., last week, to vote upon the question of giving subsidies to the Brookville, Richmond & Union City road, a branch of this road from Harrison, near Cincinnati, on its Whitewater division, to Richmond, and thence to Union City, resulted in a victory for the road at Richmond, where \$17,500 was voted, but in Boston Township, where \$10,000 was asked, the bonus was defeated.

Colorado Midland.—General Manager Colibrán states that work will begin on the branch to Cripple Creek, Col., as soon as the reports from the engineers now in the field have been received, and the route is finally selected. It is claimed that the engineers have found a new pass which will save between \$50,000 and \$75,000 in the construction of the branch over previous surveys.

Denver & Rio Grande.—A survey has been made by the company for an extension of the line at Creede, Col., to the mouth of the Nelson tunnel. The grade is four percent.

Elizabethtown & Austin Springs.—The charter of the company was filed in Tennessee last week. The proposed road is to extend from a point two and a half miles from Austin Springs, in Washington County, on the Charleston, Cincinnati & Chicago, southeast across the Watauga River, up Butler's Hollow, to a point on the East Tennessee, Virginia & Georgia, thence up Lick Creek and the Watauga River to the end of Lynn Mountain.

Fairmont, Morgantown & Pittsburgh.—The very wet weather that has prevailed throughout the section through which this company is building has greatly hindered active operations, but this week 500 men will be put on the work. The Baltimore & Ohio has contracted with Dewing & Son, of Point Marion, O., for 1,000,000 ft. of bridge timbers to be used on the line.

Fort Wayne & Belle Isle.—The company filed articles of incorporation in Michigan last week. The capital stock is \$250,000, and the chief office is to be at Detroit. The route is not given.

Fort Worth & Trinity Valley.—New directors of this company will be elected at a meeting at Fort Worth, Tex., June 25. It is also proposed to authorize the issue of \$2,000,000 of bonds to build the road. In the meantime the survey will be run from Fort Worth northwesterly to a point on the Red River in Clay County, Tex., where it is proposed to make a connection with an extension of the Chicago, Rock Island & Pacific, now being built through the Indian Territory. The line will be about 100 miles long, and will parallel the Fort Worth & Denver City for most of the distance.

Goshen Lateral.—Nearly all of the right of way has been secured for this road through Goshen, Ind., and agreements have been made with the officers of the Cleveland, Cincinnati, Chicago & St. Louis and the Lake Shore & Michigan Southern for building the road, which will be three miles long. The route is from a connection with the Lake Shore road south to the Goshen Hydraulic Canal, and along the canal bank south to the southern limits of the city, and then east to the Michigan Division of the "Big Four." The two roads will use the new line under agreements with its officers for the business of the manufacturers along the Hydraulic Canal and in the western end of the city. For part of the distance a 7-ft. embankment will be built and four or five bridges are to be constructed, but none of the work is very difficult. Officers of the new road state that it is quite probable that the Illinois, Indiana & Iowa will build from Knox, Ind., through to Ohio via Goshen, and in that case it will undoubtedly use the tracks of the Lateral Railway. Efforts are being made to get the Wabash, whose tracks are only four miles south, and the Baltimore & Ohio, which is 12 miles south, to extend a spur to Goshen.

Gouverneur & Oswegatchie.—The locating survey has been finished for this new road, which is an extension of the Rome, Watertown & Ogdensburg through St. Lawrence County, N. Y., and the right of way has been secured. Moffett, Hodgkins & Clarke, of Syracuse, N. Y., who have the contract to build the 12 miles east of Gouverneur, are reported to have sublet the entire work. The contractors have six months to complete the road.

Great Northern.—It is reported that this company is securing right of way between Red Lake Falls and Pelican Rapids, Minn. It is probable that the line now under construction into Red Lake Falls will be extended south to a connection with the Pelican Rapids branch, but this would require the construction of about 75 miles of new road.

Hearne & Brazos Valley.—A bonus of over \$50,000 has been raised for an extension of this line from Hearne north to Calvert, Tex., a distance of about 10 or 12 miles, but no action has yet been taken by the company toward building the branch.

Hoxie & Pocahontas.—About five miles of this line has been graded from Hoxie, Ark., and three miles additional has been partially graded. The contract for the grading and tracklaying has been let to Carroll C. Hughes, of Hoxie, Ark. The road is to extend from Hoxie, Lawrence County, north, via Pocahontas and through Randolph County, to the Missouri state line, a distance of about 35 miles. The right of way has been cleared to Pocahontas, and it is expected to complete the road to that town this year. The line will extend through one of the richest counties in northern Arkansas. The work is at present delayed by high water. There will be one bridge about 240 ft. long to construct over Black River at Pocahontas, and in addition about 400 ft. of trestles to build. W. D. Gentry, of Chicago, is President.

Iowa Central.—Recently the company made a proposition to build into Ottumwa, Ia., on condition that the city furnish the right of way, station grounds, and a \$40,000 bonus. Now the Ottumwa Land Co. offers the company a right of way over its property from the sub-

urbs down to the centre of the city, giving station grounds down town, on Wapello street, instead of South Ottumwa. It is said this will suit the railroad much better and may serve to reduce the bonus asked. The building of the road on this line will virtually redeem 300 acres of land in the central portion of the city, which has been subject to overflow.

Julisco Pacific.—One of the New York directors of this new company says: "We intend to build a road from Manzanillo, on the Pacific coast of Mexico, northeast to Gaudalajara, a distance of about 325 miles. We take over 50 miles of constructed road from Manzanillo to Colima, from the Mexican National Construction Co., and we will build under a modified charter from the Mexican Federal and State Governments the remaining 166 miles to Gaudalajara."

Kanawha & Michigan.—Work on the extension from Malden, W. Va., to the Gauley River, where it is to connect with the Chesapeake & Ohio's Gauley River extension, was commenced last Wednesday week. The surveys were finished the day before and the contractor and his men were on the ground to begin the next morning. The work on the Chesapeake & Ohio's Gauley branch was begun a few days in advance, and work is to be pushed rapidly on both lines.

Kickapoo Valley & Northern.—This road was opened for passenger and freight traffic last week. It was built last year by the United States Construction Co., and extends from Waukesha, Wis., a station on the Chicago, Milwaukee & St. Paul, about 18 miles east of Prairie du Chien, in Crawford County, north a distance of about 35 miles to Soldiers' Grove.

La Porte, Houston & Northern.—Engineer Woodbridge has completed the locating survey for this new road between La Porte on Trinity Bay and Harrisburg, near Houston, Tex. The line will be 16½ miles long, and will have very easy grade. J. F. Allen, of Lincoln, Neb., who has the contract for the grading, will begin work immediately.

Little Falls & Dolgeville.—The construction on this line between Little Falls and Dolgeville, N. Y., is now practically completed with the exception of the iron bridges. This is the principal work which delays the opening of the line. There are four iron bridges on the 10 miles of new road, 51 ft., 71 ft., 290 ft. and 440 ft. long respectively. The contractors are Godeffroy & How, of New York, their headquarters at present being at Little Falls, N. Y.

Manistee & Northeastern.—The track on the extension to Traverse City, Mich., has been completed for about half the distance. The line has been graded for about 13 miles, leaving about one mile still unfinished.

Mexican Southern.—The work of construction on the road from Puebla, Mex., to the City of Oajaca, capital of the state of the same name, is going forward rapidly. The line will be completed in September, when the event will be celebrated with public rejoicings in Oajaca. President Diaz and the Cabinet will attend the celebration. That part of the line already in operation, from Pueblo to Tecomanaca, Mex., is showing earnings in excess of the estimates made by the engineers at the outset.

Minnesota & Wisconsin.—The contract for building 16 miles of this line has been let to Frank Jackson, of Emerald, Wis. It will extend from Woodville north to Emerald, St. Croix County, connecting the Chicago, St. Paul, Minneapolis & Omaha, and Wisconsin Central roads and affording an outlet to each for the output of the iron mines and the Eagle Furnace Co. of Spring Valley. The line south of Woodville is already built to Spring Valley. H. C. Truesdale, of Minneapolis, is President.

Monett, Bald Knob & Memphis.—This company was organized at Monett, Mo., last week, to build a proposed road from that point south through Missouri, and through the northern counties of Arkansas to Bald Knob, a distance of about 100 miles. The new line will extend through the valuable lead and zinc district in the northern part of the state.

Mount Jewett & Smethport.—This company was chartered in Pennsylvania May 27 to operate a line in McKean County from Smethport to Mount Jewett, 15 miles. The capital stock is \$150,000.

New Orleans & Northwestern.—The contract has been let to D. L. Bourland, Vice-President and Manager of the Dardanelle & Russellville Railroad of Arkansas, for building a short line from Bastrop to Collins, La. The line is seven miles long, and will be the extension of the New Orleans & Northwestern when the latter is extended to Collins, which work will probably be done in the fall. When these two lines are completed there will be a continuous road from Natchez to Bastrop.

New Roads.—A new locating survey will be begun next week for a line from Dugway, Utah, west to the Nevada state line. The engineers have completed the estimates for the first division on the line from Salt Lake City to Stockton, and a party of engineers is now making a locating survey beyond that town. These surveys are for the line projected by Col. T. P. Murray, of Salt Lake City.

A party of engineers began locating surveys last week for the extension of the railroad of the Compania Carbonifera, which owns the Fuentec coal mines, on the south side of the Rio Grande opposite El Paso, southeast to Lampazos and Monterey, Mexico.

At the last session of the Maine legislature a charter was obtained for a road from Camden to Lewiston, and the company was recently organized with Col. Elias Milliken as President, and F. E. Southard, Secretary. The building of the road is now being agitated, and the directors will probably arrange to begin the survey in a few weeks.

William Garland, of Selmonville, Ariz., a well known railroad contractor, is now examining a route for a road from Globe to Wilcox, or Bowie Station, Ariz., on the Southern Pacific. An engineer corps will begin the survey of the line in three weeks.

New York & New Jersey Terminal.—The State Commissioners of the New York Land Office have approved of the application of the company for a grant of land under the bed of the Hudson River 90 ft. wide and 70 ft. deep, from West Fourteenth street, New York City, to the New Jersey boundary line, for the use of the company's railroad.

Niagara Junction.—This company was incorporated at Albany, N. Y., May 27, with a capital of \$300,000, to construct a standard gauge road to be operated by steam, electrical or pneumatic power. The road is to be constructed from Quay and Erie streets, Niagara Falls, to a point in the town of Niagara, where connection will be made with the Lockport branch of the New York Central & Hudson River road.

Northern Pacific.—About \$20,000 has been subscribed by the citizens of Aberdeen, Wash., to procure the right of way along the north side of Chehalis River into Aberdeen, from the proposed junction with the main line of the Gray's Harbor branch, which is being built to South Bend. The company has agreed to build a branch into Aberdeen, if right of way is secured.

Osceola, Lake & Wexford.—The charter of this company was filed in Michigan last week, the capital stock being \$80,000. The principal office is to be at Cadillac.

Parkersburg Belt Line.—There are now very good prospects that a belt line will be built around the city of Parkersburg, W. Va., to connect the Ohio River Railroad and the Baltimore & Ohio and to reach the heavier shippers along the route. The project is in the hands of active citizens who have interested the railroads in it. The right of way for the line has been promised almost entirely without cost, and the project is expected to take tangible form within the next few weeks.

Pennsylvania.—W. G. Stall & Sons, contractors, of Altoona, Pa., will begin the work of building a third track along the main line from Elizabeth Furnace, near Altoona, to Fosteria, Pa., four miles, and 150 men will be employed on the contract at the start. There are three bridges in the section. The grading will be made to accommodate a fourth track.

Philadelphia & Bustleton.—The Pennsylvania began work last week on this branch line from Hart's Lane, just above the North Penn Junction, on the New York division, to Bustleton, a suburb of Philadelphia, about eight miles. It is the intention to push this work forward rapidly, and a large force of men is now engaged in grading. It is thought that before the end of the year the road will be completed. When the branch is open for traffic it is the intention of the Pennsylvania to take off of the main line the way traffic between Philadelphia and Bustleton.

Philadelphia & Northern.—Bids for constructing this road have been received and the contract will probably be awarded in a few days. The Philadelphia Council has passed an ordinance giving the company permission to build through the city, and most of the right of way has been secured. The new branch is a cut-off of the Reading from Wistar Station, on the Philadelphia & Germantown branch to Glenside Station on the North Pennsylvania Division. It is estimated that it will take about 10 months to finish the work. When this new road is completed it will relieve the New York Division of the Reading, especially of traffic bound for points on the North Pennsylvania Division; it will also shorten the distance from Philadelphia to Glenside two miles.

Philadelphia & Reading.—The company has built a spur 1½ miles long, from the new Crescent Oil Refinery, at Chester, Pa., to connect with its road below Marcus Hook on the Delaware River. The line was built to head off the Pennsylvania, which had begun to build a line from a connection with its road through Chester to the Delaware River front, crossing the Reading tracks. Last winter there were several encounters between the laborers of the two roads. The branch of the Pennsylvania is built up to the point where it is proposed to cross the Reading tracks. So far the Reading has been able to prevent the crossing being made.

The Philadelphia, Newtown & New York road, which is operated by the Reading, is preparing to make extensive improvements, in anticipation of greatly increased traffic, when it shall be connected with the Reading tracks at Logan station and its trains are running to Twelfth and Market streets. Houses in the way of the connecting link, which will be about 1.5 miles long, are being removed, and the work of construction will soon be begun. All streets will be crossed by overhead bridges. The road will be an easy one to build, and it is expected to have it finished by the time trains make use of the terminal station.

Philadelphia, Wilmington & Baltimore.—The company has begun the construction of two additional tracks on the Union Railroad from Middle street, Baltimore, to Bay View Junction, four miles from the Union Station in Baltimore.

Pittsburgh, Akron & Eastern.—President W. A. Lynch, of this road, states that the locating surveying for the Akron & Eastern, the proposed eastern extension from Akron, O., to New Castle, Pa., is about completed, and grading will be commenced in a few days. The officers expect to have the road ready for traffic this year.

Pittsburgh, Chicago, Cincinnati & St. Louis.—The third track between Medway, Pa., and Gregg, O., seven miles, is nearly completed and the third and fourth tracks are being laid between Crafton and Camp Hill. The double track now extends from Pittsburgh to Fernwood, and from Bowerston to Denison, O., with the intermediate space to be filled in.

Pittsburgh, Lake Erie & Chicago.—This company, which was incorporated in Ohio recently, has been organized by C. A. Judson and others of Sandusky, O., and they state that they intend to make the road part of a new route between Pittsburgh and Chicago. The line in Ohio will extend through the towns of Oberlin, Medina, Akron, Alliance, New Lisbon, Sandusky, Napoleon and Bowling Green.

Potomac Valley.—At the last meeting of the directors of the Western Maryland it was reported that the Cherry Run extension was nearing completion at a very satisfactory rate, and that the extension could probably be opened by June 10. The track is down as far as McCoy's Ferry, nine miles from Williamsport, Md., and there remains only four miles more to lay. The Potomac River bridge, consisting of five spans of 140 ft. each, is completed, and the trestling that was blown down a few weeks ago will be completed by the time the remainder of the line is ready for use. All the bridges are now finished except a single span over the Chesapeake & Ohio Canal, and such progress has been made on the terminals at Cherry Run that they will be finished ahead of the other work.

Roxborough.—The construction of this road, a branch of the Pennsylvania Railroad from Chelton Avenue Station, Germantown, to Corson's, Montgomery County, on the Trenton Cut-Off, is now said to be an assured fact. The building of the line was to have been commenced several months ago, after the City Councils had granted consent to construct it through the Twenty-first and Twenty-second wards, but active operations were not begun because the property-holders wanted prices for their land which could not be paid. This obstruction has been overcome, and the sales of the land required are now under way. The plans for grading, rock-cutting and masonry have been submitted to contractors, and some of their estimates have been received. Operations

will be under way within six weeks, and the road will be in running order by January.

St. Louis, Chicago & St. Paul.—The organization of this company was completed at St. Louis this week. It was chartered in Illinois early in May. Henry O'Hara, of St. Louis, is President. This company will purchase the bluff line, or St. Louis, Alton & Springfield, at the Receiver's sale next month, and will then extend it from Alton to East St. Louis. The Wabash interest in the property was sold recently to the syndicate represented by Henry O'Hara and Post, Martin & Co., of New York.

San Francisco & Northern Pacific.—Work was commenced recently on an extension of the Fulton & Guerneville branch across the Russian River and through the red wood timber district in Sonoma County to the Meca lumber tract. The iron bridge over the Russian River will be over 400 ft. long, and the trestle approaches on either side will be over half a mile long.

San Francisco & Salt Lake.—Articles of incorporation were filed in California last week by this company, which is to be one of the divisions of a new route between San Francisco and Salt Lake City. The California charter is for a line 250 miles long, to the Nevada State line. This is only one of nearly a dozen companies organized in the last few years to build a competing transcontinental road. None of the projects has ever got further than having a survey made for a comparatively few miles. The local papers still, however, keep right on publishing editorials to show the necessity of a competing line between the coast and Utah, and to prove that the building of such a line very soon is probable.

Seattle, Sidney & Gray's Harbor.—A preliminary survey for this road will probably be started in a few weeks. A reconnaissance has already been made from Sidney to the upper end of Hood Canal. The route is then to be either along that channel to Union City or across to Shelton, continuing in a southwesterly direction to a point on Gray's Harbor. The distance will be about 80 miles from Sidney to Gray's Harbor. It is proposed to establish a line of steamers from Seattle to Sidney, a distance of 16 miles, to run in connection with the railroad.

Shickshinny & Huntingdon.—The charter of this company was filed in Pennsylvania last week. The company is to build through Luzerne County. The capital stock is \$60,000.

Southern Pacific.—Grading is practically finished on the line from Collis to Fresno, Cal., a distance of 14 miles, and the tracklaying is progressing rapidly. When the work is completed the line will form a connecting link between the West Side branch and the company's main line at Fresno. Tracklaying on the reconstruction now under way at Dragon Summit will be completed in a few days. Grading has been finished. This line will be ready for operation within two weeks. A large force of men is at present employed on the new road from Bakersfield, Cal., to the asphaltum beds, a distance of 45 miles. Grading has been finished for a distance of 14 miles and tracklaying is going on rapidly. The line will not be in condition for operation before next September.

Tintic Range.—Amended articles of incorporation have been filed in Utah for the extension of the line from Tintic northwesterly through Juab and Tooele counties to near Dugway Pass and the Dutch Mountain mining district, to the Fish Springs mining district and to Deep Creek, at the Nevada State line. The total distance is about 225 miles. There is no immediate prospect of the building of this extension or of any line beyond Tintic. The company is now consolidated with the Rio Grande Western, which has exchanged the \$2,500,000 new common stock, recently authorized, for the stock of the Tintic Range.

Toledo, Walbonding Valley & Ohio.—The construction of the middle division of this road, which was placed under contract last fall, is now reported to be practically completed, and trains may be run over the line within 60 days. The road is now being built from Loudonville southeast to Coshocton, O., a distance of 46 miles, connecting the Ft. Wayne and Panhandle divisions of the Pennsylvania. This will complete a line from the coal fields in southern Ohio to Toledo. No other work is now under contract, but surveys have been made east of Coshocton.

Trinidad & Grey Creek.—J. R. De Remer, a railroad contractor of Trinidad, Col., states that he has just contracted to build a road from Trinidad to Grey Creek, Col., a large mining district tributary to Trinidad. Work will begin at once.

West Virginia & Pittsburgh.—The bridge over Elk River on the Gauley extension is almost completed and a work train was taken over it last Thursday. This bridge has been holding back the work beyond the Gauley River, which will now be pushed with all possible rapidity. Tracklaying on the Fickens division of the Buckhannon River extension of this road has been completed, and Blodgett & Co., who were doing the work, have removed their camp to beyond the Elk River bridge. A contract has been made with the Wrought Iron Bridge Co., of Canton, O., for the erection of a number of bridges on the Gauley extension.

Wheeling & Connellsville.—The engineers have finished the preliminary surveys of the route east of Wellsburg, W. Va., and are at work compiling the data preparatory to deciding upon further steps to be taken.

Wisconsin, Bee Line & Superior.—A first mortgage made in favor of the Farmers Loan & Trust Co., New York, was filed at Fond Du Lac, Wis., last week. It is reported that over \$1,000,000 of the bonds have been negotiated in New York. C. D. Smith, of Fond Du Lac, is President.

Yakima & South Coast.—Track on this branch of the Northern Pacific has been laid to within half a mile of the heavy cut at the summit near South Bend, Wash., the Pacific Terminus, where 27,000 yards of earth and rock is to be removed. Orders have been issued to prosecute work on this cut night and day. Track has been laid to the top of the mountain divide, about 36 miles west of Chehalis, leaving about 20 miles to be finished before the line is completed.

GENERAL RAILROAD NEWS.

Canadian Pacific.—In order to carry out the order of the new Canadian act the company invites subscriptions for \$2,000,000 four per cent. perpetual consolidated debentures at 101, bearing interest from July. The object of the issue is to acquire obligations bearing higher interest of which the company is the principal guarantor.

Atchison, Topeka & Santa Fe.—The gross earnings, operating expenses (exclusive of taxes and rentals) and net earnings of the railroad and its auxiliary lines for the month of April were as follows:

	Gross earn.	Oper. expen.	Net earn.	Mileage
Railroads owned and controlled.....	\$2,715,767	\$1,937,084	\$778,683	6,540
Roads jointly owned, Atchison Co.'s one-half.....	153,276	111,090	42,186	587
Total, Atchison system.....	\$2,869,043	\$2,048,174	\$820,869	7,127
St. Louis & San Francisco.....	\$477,324	\$294,140	\$183,254	1,328
Roads jointly owned with Atchison.....	147,976	207,555	70,421	538
Total, Frisco system.....	\$625,370	\$401,695	\$223,675	1,864
Aggregate, both systems.....	\$3,494,413	\$2,449,869	\$1,044,544	8,991

The comparative statement for all lines is as follows:

	Gross earn.	Net earn.	Per mile.	Gross earn.	Net earn.	Mileage.
April, 1892.....	\$2,869,043	\$820,869	\$115.17	7,127		
April, 1891.....	2,534,229	759,373	106.77	7,114		
Increase.....	\$334,814	\$61,295	\$8.41	13		
Frisco system:						
April, 1892.....	\$625,370	\$223,675	\$120.00	1,864		
April, 1891.....	654,416	198,138	106.52	1,863		
Inc. or dec. D. \$9,047	I. \$25,636	D. \$15.82	I. 13.68	I. 1		
Aggregate general system:						
April, 1892.....	\$3,494,413	\$1,044,544	\$115.17	8,991		
April, 1891.....	3,308,655	957,623	106.67	8,977		
Increase.....	\$185,757	\$86,920	\$20.08	\$0.49		

Chicago, Burlington & Quincy.—The following statement gives the earnings for April, including those of controlled roads:

	1892.	1891.	Inc. or dec.
Month of April:			
Gross earnings.....	\$2,757,529	\$2,484,667	I. \$272,862
Oper. expen.....	2,073,965	1,565,179	I. 508,787
Net earnings.....	\$683,563	\$919,488	D. \$235,925
1/12 charges.....	810,000	736,156	I. 73,844
Deficit.....	\$126,337	Sur. \$124,302	D. \$250,640
Jan. 1 to April 30:			
Gross earnings.....	\$12,067,569	\$9,541,681	I. \$2,525,888
Oper. expen.....	8,203,190	6,496,381	I. 1,706,809
Net earnings.....	\$3,864,379	\$3,045,300	I. \$819,079
1/12 charges.....	3,210,000	3,189,744	I. 20,256
Surplus.....	\$654,379	Def. \$137,444	I. \$791,823

Chicago Great Western.—Chairman Stickney, speaking this week of the reorganization of the Chicago, St. Paul & Kansas City, said: "The proposition is to convert the income bonds and stock of the Chicago, St. Paul & Kansas City into the common stock of the Chicago Great Western, the second mortgage bonds into preferred stock, and the first mortgage bonds into first preferred stock. The plan also contemplates the raising of \$3,000,000 in cash against a like amount of preferred stock at par in the nature of a voluntary assessment on the income bond and stockholders, to which, as has been said, more than two thirds have assented."

Kansas City, Wyandotte & Northwestern.—The transfer of this road to Jay Gould in accordance with the agreement made over a year ago will probably soon be accomplished. The suit of the Northwestern Construction Co., which built the road, against Mr. Gould has been discontinued, a compromise having been made. The road was built in 1887 and 1888, the main line running northwest from Kansas City to Virginia, Neb., 149 miles, the total mileage operated being 235 miles. The road was placed in the Receiver's hands in March, 1890, in a suit for foreclosure brought by the Farmers' Loan & Trust Co. of New York. The company at that time had issued \$3,750,000 of bonds, about \$1,400,000 of this being held in New England and the balance by the Northwestern Construction Co. The securities held by the latter were transferred to Jay Gould with the exception of about \$400,000, the validity of which was disputed. The suit was brought to compel him to accept these bonds.

New York, Lake Erie & Western.—The following is the report of the earnings for April and the six months:

	1892.	1891.	Inc.
Month of April:			
Gross earn.....	\$2,495,235	\$2,274,032	\$221,203
Oper. exp.....	1,686,133	1,490,975	195,158
Net earn.....	\$809,102	\$783,057	\$26,045
Rentals.....	219,130	196,232	22,898
Balance.....	\$589,863	\$586,825	\$3,038
October to April:			
Gross earn.....	\$17,633,629	\$16,336,791	\$1,296,838
Oper. exp.....	12,128,224	10,980,079	1,148,145
Net earn.....	\$5,505,405	\$5,356,712	\$148,693
Rentals.....	1,525,447	1,459,387	66,060
Balance.....	\$7,030,852	\$6,816,100	\$214,752

New York & New England.—The adjourned annual meeting, May 31, has again been adjourned, this time subject to the call of the chairman. The adjournment was made at the request of President Parsons, who stated that the Board of Directors had considered the question of securing an independent entrance to New York City, but wanted more time to perfect plans.

Oshkosh & Mississippi River.—The stock of this company held by the city of Oshkosh, Wis., amounting to \$75,000 par value, has been transferred to the Chicago, Milwaukee & St. Paul, which purchased it at 12 1/2 cents a share. The road extends from Oshkosh east to Kipon, Wis., 30 miles, and was built in 1871, and leased soon after to the St. Paul, which guaranteed the interest on the bonds.

Pennsylvania.—The following is the statement of earnings for April of the lines east of Pittsburgh:

	1892.	1891.	Inc.
Gross earn.....	\$5,746,730	\$5,379,003	\$367,727
Oper. expen.....	4,008,608	3,770,460	238,148
Net earn.....	\$1,738,122	\$1,608,543	\$129,579
Four Months to April 30.			
Gross earn.....	\$21,423,373	\$20,649,506	\$773,867
Oper. expen.....	15,765,491	14,718,357	1,047,134
Net earn.....	\$5,657,882	\$5,931,149	\$273,267

All lines west of Pittsburgh and Erie for April, as compared with the same month in 1891, show an increase

in gross earnings of \$453,711, and a decrease in net earnings of \$42,504. For the four months ending April 30 the gross earnings show an increase of \$1,947,335, and the net earnings show an increase of \$519,333.

Philadelphia & Reading.—The statement of earnings for April, 1892, as compared with the same month of 1891, shows the following results:

	1892.	1891.	Inc. or dec.
Gross receipts.....	\$1,701,411	\$1,610,321	I. \$91,090
Oper. expenses.....	1,012,674	923,871	I. 88,803
Profit in operating.....	\$688,737	\$686,450	I. \$2,287
Other receipts.....	50,736	55,496	I. 4,760
Profit for month.....	\$739,523	\$741,946	D. \$2,423
Expn. for perm. improv.....	8,700	50,445	D. 41,745
One-twelfth fixed charges.....	625,000	611,769	I. 13,231
Surplus.....	\$105,762	\$67,114	D. \$38,648

The operations of the Central of New Jersey for the four months of the fiscal year ending April 30 show an increase in net earnings of \$141,227. The increase in net earnings for 1892 over the same period of 1891 is over 8 1/2 percent. At this rate the net earnings for the year will be sufficient to pay the 7 per cent. guaranteed by the Reading, and give the Reading from \$300,000 to \$500,000 profit. It is impossible at this date to give the figures of the Lehigh Valley, but it is fully expected that the showing will be as good, if not better, than the Jersey Central's.

The Attorney-General of New Jersey this week made application in the Court of Chancery for an injunction to dissolve the relations between the Central of New Jersey, Philadelphia & Reading and Port Reading companies, on the ground that the tripartite agreement between them was illegal. The relief asked for is that the lease of the New Jersey Central to the Port Reading shall be declared void. The court granted a preliminary injunction.

In Pennsylvania Commissioners have been appointed to take testimony in the case brought by the state against the companies, and hearings will be given at Philadelphia, New York and Boston.

Richmond & West Point Terminal.—Drexel, Morgan & Co., of New York, have agreed to make an examination of the affairs of the system with a view to proposing a plan of reorganization. The firm was asked to undertake the rehabilitation of the system by the committee, including W. E. Strong, Samuel Thomas and W. P. Clyde, which was appointed by the security holders on the same day that the failure of the Olcott Committee's plan was announced. Spencer, Trask & Co. and Kessler & Co., representing large interests also made similar requests to Drexel, Morgan & Co. The committee of security holders, in its letter to the bankers, recited that from various causes not necessary to be specifically enumerated, the affairs of the company had become seriously embarrassed, and the vast interests which it represents are threatened with the danger of receivership and disintegration. The committee believes that a plan can be devised which would save the property from disruption and loss, consequent upon needless litigation, and the firm was requested to take up the matter and appoint a committee to suggest a plan of reorganization which, in its judgment, would be fair and equitable to all interests involved.

St. Louis, Alton & Springfield.—Judge Creighton, in the Illinois State Circuit Court, at Springfield, has issued a decree of foreclosure in the case of B. F. Johnson against the railroad company, and has ordered the road sold. This is the result of an agreement between the railroad company and the Farmers' Loan & Trust Co., of New York, holding \$1,200,000 first mortgage bonds, and the Atlantic Trust Co., holding second mortgage bonds of \$300,000. The lowest bid must be \$450,000 or there will be no sale.

Smithtown & Port Jefferson.—A judgment for \$1,070,322 against this company obtained by the Long Island Railroad was recorded last week. The road was built by a number of citizens and the town of Smithtown to connect with the Long Island road, and an operating contract was entered into on March 20, 1871. It is for non-fulfillment of this contract that judgment was obtained in the Supreme Court, Brooklyn a few days ago. The Long Island recently settled with the town of Smithtown by paying \$5,000 for its interest in the road. By virtue of the judgment the Long Island will obtain complete control of the Port Jefferson branch.

Western New York & Pennsylvania.—The contract under which trains of the company were run over the Lake Shore tracks from Oil City to Stoneboro, Pa., which expired about 18 months ago, has been renewed, and went into effect June 1. The Lake Shore concedes the right to the company to make local stops, which it was not allowed to do under the old contract.

Western Maryland.—It is the purpose of the company to resume interest payments to the city of Baltimore, July 1, upon the following bonds of the company: Six months' interest on \$43,500 first mortgage 6 per cent. bonds; upon \$178,500 preferred second mortgages 6 per cent. bonds; upon \$1,704,000 3 1/2 per cent. city stock; upon \$225,330 6 per cent. funding certificates, and upon \$684,000 4 per cent. city stock, making the total amount of interest \$54,825. Last winter offers were made by the Baltimore & Cumberland to purchase the city's interest in the road. This led to the introduction of an ordinance in the Council providing for a resumption of interest payments by the company as of Jan. 1, provided the Mayor and the City Council would agree to give no consideration to any proposition for the purchase or lease of the road during a period of five years. It is asserted that the company will be able to demonstrate in a much shorter time the ability to pay regularly its entire interest obligation to the city.

East Tennessee, Virginia & Georgia.—The request for an injunction for a Receiver for this road has been refused by the Chancellor at Knoxville. The injunction was asked to prevent the consolidation of the road with the Richmond Terminal properties, and the application was made a few weeks ago by local stockholders holding only a few shares of stock.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, June 1, 1892.

The Trans-Continental Association and the Southwestern Railway Steamship Association are holding meetings here this week. The latter association is at work

on the proposed new agreement, which, if adopted, as now proposed, will materially change the machinery of the association by dispensing with the services of a chairman and placing the affairs of the association in the hands of an executive board of three with full power to make rates and manage the association affairs.

Indications are that the eastern and western lines will soon come to a better understanding in regard to several matters of difference between them. The recent decided stand taken by the western lines in meeting the cuts of the "S-o" line on wool has hastened matters. The Lake Shore & Michigan Southern and the Michigan Central asked to be allowed to participate in the wool traffic which was being consigned east over the Chicago & Grand Trunk. This was granted by the western lines after these central traffic lines had agreed to re-establish the prorating arrangements westbound which were discontinued about a year ago. The other central traffic lines are still inclined to stand out, but will probably wheel into line.

The Commissioners of the Western Traffic Association give notice of a session of the Board June 9, at which time, among other subjects, they will reopen the question of divisions via Illinois Junction points and the application of Mississippi River and Peoria rates. This gives the Burlington an opportunity to present additional arguments in the matter of divisions via Beardstown and Chapin, which was postponed by the Advisory Board at the New York meeting on account of the absence of President Perkins.

No announcement having been made of the adoption of the new agreement on transcontinental passenger commissions, which was drawn up at the last meeting of the Advisory Board, and left with the chairman of the Commission to secure the necessary signatures of the presidents before June 1, it is evident that some of the lines have refused to sign it. As the Atchison, Topeka & Santa Fe agreed to suspend its proposed reductions in second class rates only on condition that the agreement should be adopted, it will now probably put them into effect as originally announced.

Complaint has been made to Chairman Midgley of the Western Freight Association that some of the Association lines are participating in a cut of from 40 to 50 cents per 100 lbs. on first-class from New York to the Missouri River, and an investigation will be had.

At a meeting of the Trans-Missouri Association yesterday, the resignation of Chairman James Smith was accepted, and the Secretary will have charge of affairs until July 1. The association adjourned until June 28, when a new chairman will probably be elected. Mr. Smith was dropped as a Commissioner of the Western Traffic Association at the Advisory Board meeting in New York.

The Central Traffic and Trunk Line associations have agreed to advance rates on grain to a basis of 22 1/2 cents per 100 lbs., Chicago to New York, effective June 15, at which time the advance in the sixth class to 25 cents per 100 lbs. also takes effect.

The Chicago, Rock Island & Pacific will on June 16 put in effect a rate of \$2 a ton on ore and bullion, car loads, from Colorado common points to the Missouri River, in accordance with its notice to the Advisory Board of the Western Traffic Association. The Burlington will take similar action.

The Rock Island will also put in effect on June 22 a reduction on all classes and commodities westbound to Colorado common points.

Traffic Notes.

The Baltimore & Ohio is running emigrant trains through from Baltimore to Chicago by way of Pittsburg and over the Pittsburg & Western Railroad.

A law has been passed and approved in Kentucky requiring separate accommodations in passenger trains for negroes, the same as in various other Southern States. It goes into effect 30 days after the adjournment of the legislature.

The two Pullman car conductors who were arrested and tried in Louisiana for giving accommodations to negroes in sleeping cars, have been acquitted. The State Supreme Court decided that the passengers were interstate passengers, and that the State law, requiring separate accommodations for the two races, is unconstitutional so far as it applies to such passengers.

The April report of the Alabama Car Service Association, shows that the average detention on all cars handled was 1.1 days. It will be remembered, from a recent note in these columns, that this association handles a large number of mineral cars, which are unloaded very promptly. The April report shows that 9,800 cars handled at stations in the Birmingham District were detained by consignees only .84 day each.

The Philadelphia & Reading has modified its regulations concerning the stopping of grain at junctions to await orders for change in destination. This privilege had been freely granted, until the wholesale dealers of Philadelphia abused it, and it was finally withdrawn a few weeks ago; but the company has now concluded to hold such cars two days without charge, and seven days as a maximum, though regular demurrage will be charged after 48 hours.

Two members of the Interstate Commerce Commission held a hearing at Minneapolis last week on the complaints of millers of that city concerning rates on wheat from Red River Valley, which are alleged to be lower, proportionately, to Duluth than to Minneapolis. It was shown that the rate on flour from Minneapolis to Duluth in 1884 was 15 cents per 100 lbs., and in 1885 it was reduced to 7 1/2 cents. Since then it has been lowered to 5 cents, and now the millers claim that the present rate of 7 1/2 cents is 2 1/2 cents too high. The millers also complain that the railroads are hauling wheat from 80 to 150 miles further to reach Duluth than to Minneapolis, at the same price. It was brought out during the hearing that the mills of Minneapolis in 1880 produced 2,000,000 barrels of flour; the business increased until in 1891 the output was 8,000,000 barrels, and it is anticipated that the product of 1892 will be 9,000,000 barrels. It was shown that 80 per cent. of this is shipped via the great lakes. During the hearing a number of railroad men, millers and other manufacturers testified, and on Saturday the hearing was adjourned to be taken up at Washington before the full Commission at an early day.

Virginia Coke for Mexico.

A shipload of coke has recently been sent from Norfolk, Va., to Tampico, Mex. This is Pocahontas coke from the ovens on the lines of the Norfolk & Western. The shipment is made as an experiment. Mexican iron foundries have heretofore drawn their main supplies of coke from Wales, though a little has been sent from Colorado.

GEO. WESTINGHOUSE, JR.,
President.T. W. WELSH,
Supt.JOHN CALDWELL,
Treasurer.W. W. CARD,
Secretary.H. H. WESTINGHOUSE,
General Manager.

THE WESTINGHOUSE AIR BRAKE COMPANY

PITTSBURGH, PA., U. S. A.,

MANUFACTURERS OF THE

WESTINGHOUSE AUTOMATIC BRAKE

The WESTINGHOUSE AUTOMATIC BRAKE is now in use on 24,000 engines and 325,000 cars. This includes (with plain brakes) 232,000 freight cars, which is about 23 PER CENT. of the Entire Freight Car Equipment of this country, and about 80 per cent. of these are engaged in interstate traffic, affording the opportunity of controlling the speed of trains by their use on railways over which they may pass. Orders have been received for 173,000 of the Improved Quick-Action Brakes since December, 1887.

The best results are obtained in freight train braking from having all the cars in a train fitted with power brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped. Below is a graphical illustration of the progress made in the application of the Automatic Brake to freight cars since its inception.

Year.	No. per year.	Grand total.
1881	105	105
1882	1,085	1,190
1883	4,966	6,156
1884	15,051	21,207
1885	10,410	31,617
1886	8,946	40,563
1887	9,281	49,844
1888	27,696	77,540
1889	26,065	103,605
1890	50,502	154,107
1891	39,061	193,168

193,168 freight cars fitted with the Westinghouse Automatic Brake, which is nearly 20 per cent. of the Entire Freight Car Equipment of this country.

E. L. ADREON, Manager.

JOHN B. GRAY, Agent.

C. C. HIGHAM, General Supt.

THE AMERICAN BRAKE COMPANY.

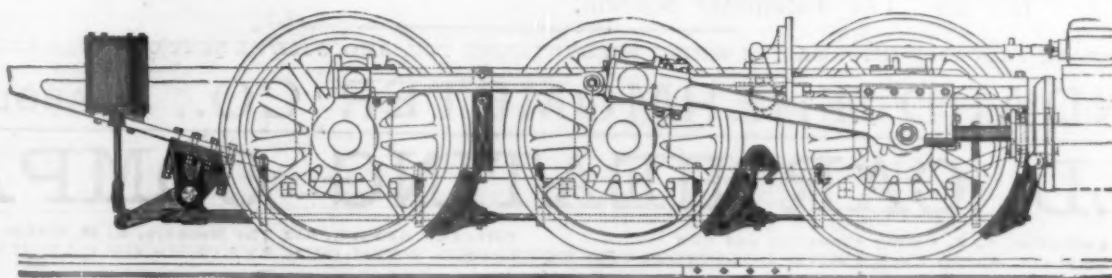
NEW YORK OFFICE,
160 Broadway, JOHN B. GRAY, Agent.

THE WESTINGHOUSE AIR BRAKE CO., Lessee,
MANUFACTURERS OF

CHICAGO OFFICE,
GRAND PACIFIC HOTEL.

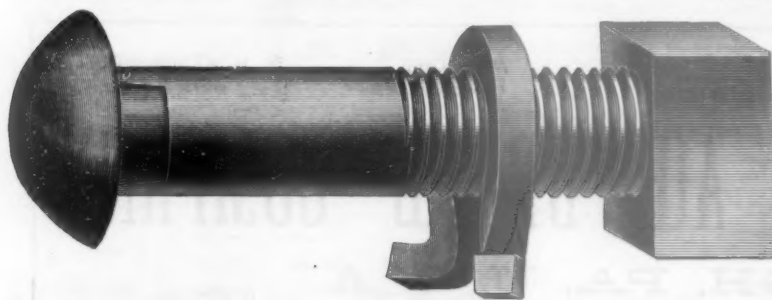
LOCOMOTIVE BRAKES.

General Offices and Shops, Second and Tyler Sts., ST. LOUIS, MO., U. S. A.



Standard Outside Equalized Pressure Brake, for two or more pairs of Drivers, furnished to operate with either STEAM, AIR or VACUUM.

THE "STANDARD" NUT LOCK



Manufactured under D. O. Ward's Patents by the
STANDARD NUT LOCK CO.,
 NOS. 236-248 BANK ST., NEWARK, N. J.
 SAMPLES FREE.

This nut lock is presented on its merits as the best and cheapest device for securing track joints.
 It is a torsional loop made of good quality of tempered spring steel, having horizontally inclined foot pieces, which are curved inward, thereby greatly increasing the spring resistance and acting simultaneously; rests upon the base of angle bar, or underlying rail base in case of fish plate, preventing the loop portion from rotating and hammering down thread of bolt.

The nut lock for $\frac{3}{4}$ bolt made of $\frac{1}{4}$ in. square steel, standard pattern, yields a tension of 4,300 lbs. on the bolt, which is sufficient to reduce the wear of the bearing surfaces of the angle bars on the rails, imparting, as it does, a uniform bearing the entire length of the bar.

The "Standard" Nut Lock has sufficient elasticity to maintain a tight joint, which cannot be truthfully said of many light-weight single coil washers.

The "Standard" Nut Lock is, in its superficial form, similar to an annular coil twisted out of plain, i. e., the curved shoulders or ends of the loop proper are spread in the usual manner of spring coils, at which bearing points the locking friction is equal to that of the best single coil washer, and added to this it is terminated in inwardly curved extensions, which must apparently furnish additional short leverage spring force of a torsional character.

Distinctive Merits of the "Standard" Nut Lock, Condensed:

Fixedness of position—cannot rotate and hammer down threads of bolt.

Cannot get one end into elongated slot of angle-bar.

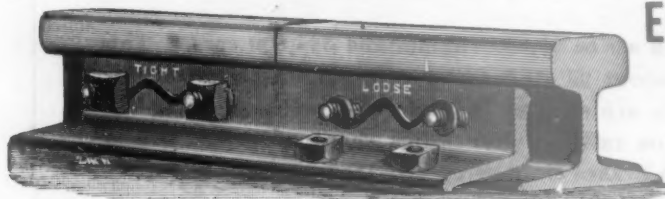
Unlike any permanently placed, double washer, the Standard is interchangeable regardless of distance between bolts.

Cannot be put on wrong side out, as the outward projection of the foot pieces would prevent the nut being turned up.

Has more spring power directly under the nut than any two ordinary coil nut locks.

Being fixed in position, it offers double the locking friction of nut locks, which when in their dead "set" condition turn back with nut by the vibrative effect of passing train.

The "Standard" Nut Lock embodies the old principle of spring power improved by overcoming the objection to the double washer or nut lock, and covering the weak points of the single coil washer.



Excelsior Automatic Nut-Lock and Fish Plate Spring

These Nut Locks have been adopted by the New England Road-Masters, in Conventions held at Hartford, Conn., Oct. 19 and 20, 1887, and Boston, Mass., Aug. 15 and 16, 1888, as the best Nut Locks known.

Sample lots furnished for trial, free of expense, by forwarding the distance between centres of fish-plate bolts. Correspondence and orders solicited.

RUFFNER & DUNN,

Patentees and Sole Mfrs., SCHUYLKILL FALLS, Philadelphia, Pa.



Simple.
 Easily
 Applied.
 Very
 Effective.

THE NATIONAL LOCK WASHER

THE ONLY POSITIVE NUT LOCK IN COMBINATION WITH ELASTICITY.

Sixty Millions in Use in
 Railroad Track



For Use on All Kinds and
 Classes of Work.

THE NATIONAL LOCK WASHER CO., Newark, N. J.

Made for all
 sizes of bolts.

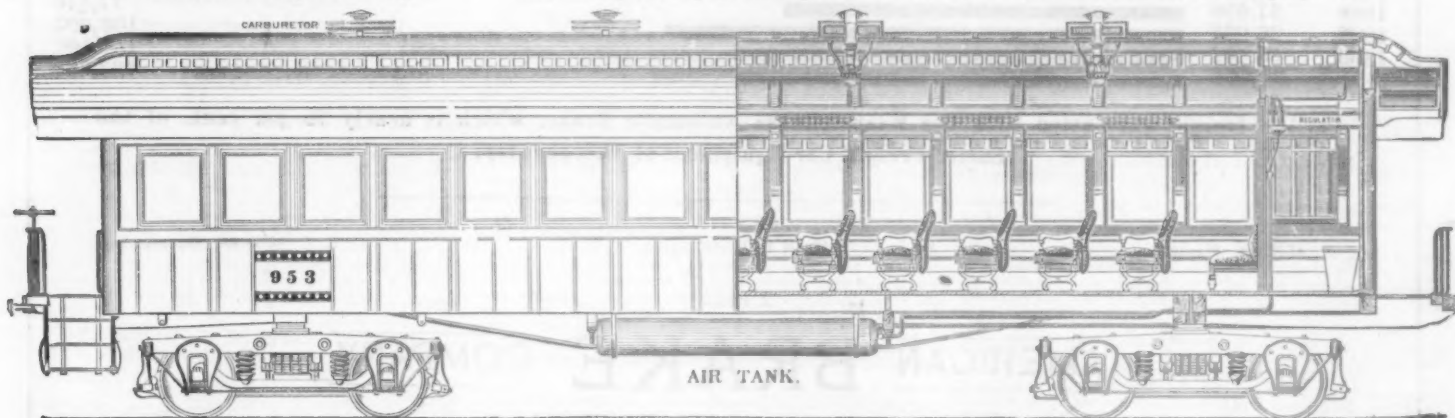
A trial is re-
 quested.

Samples free of
 expense.

THE FROST DRY CARBURETOR SYSTEM OF CAR LIGHTING.

The Greatest Light of the Age.

Extensively Used by the Pennsylvania Railroad and the Pullman Palace Car Company.



GENERAL ARRANGEMENT OF PARTS OF LIGHTING SYSTEM ON CAR

It cannot fail to attract the attention of practical railroad managers on account of its absolute safety, durability, simplicity, efficiency and its great economy. Each lamp gives 100 candle-power illumination. One hundred hours' continuous service from one charging of the carburetor.

THE RAILROAD LIGHTING & MFG. COMPANY.

Office, 700 and 701 Girard Building, Philadelphia, Pa., U. S. A.

WE HAVE JUST ISSUED FOUR NEW CATALOGUES:

- No. 26. Metallic Thermometers for Mechanical Uses.
- No. 27. Metallic Thermometers for General Use.
- No. 28. Thermostats and Thermometers with Electrical Attachments.
- No. 29. The Telemeter System.

THEY CONTAIN VALUABLE INFORMATION WHICH WILL INTEREST YOU, AND WILL BE SENT ON APPLICATION TO THE

STANDARD THERMOMETER CO., PEABODY, MASS.

GOLD CAR HEATING COMPANY

NEW YORK ADDRESS: N. E. Corner Frankfort and Cliff Sts.
 UPWARD OF 4,000 CARS AND LOCOMOTIVES EQUIPPED WITH OUR SYSTEMS OF CAR HEATING.

CHICAGO OFFICE: 652 The Hookery, E. H. GOLD, Representative.

STEAM COUPLINGS.

Gold's INTERCHANGEABLE, with Gravity Relief Trap.

UNIVERSAL,

WESTINGHOUSE TYPE,

to couple with SEWEL.

GIBBS,

We own the Sole Rights under United States Patents to put Traps on Steam Couplings.

Send for Catalogue, etc

A. W. SOPER, President.

ROBT ANDREWS, Vice-President.

R. M. DIXON, Engineer.

C. L. GATELY, Secretary.

W. R. THOMAS, Treasurer.

The Safety

THE HEATING SYSTEMS.

BY HOT WATER CIRCULATION AND DIRECT STEAM WITH
REGULATING DEVICES.
RELIABLE AND UNIFORM HEAT.
ECONOMICAL AND RAPID CIRCULATION.
GIBBS' AUTOMATIC COUPLER OF WESTINGHOUSE TYPE,
ABSOLUTELY STEAM TIGHT.

THE LIGHTING SYSTEM.

THE CELEBRATED PINTSCH COMPRESSED OIL GAS METHOD
IN USE ON OVER 40,000 CARS IN EUROPE AND AMERICA.
THE BEST, MOST ECONOMICAL AND ONLY SAFE LIGHT FOR RAILROAD PURPOSES.
IN BRILLIANCY AND CLEANLINESS UNSURPASSED.
THIS SYSTEM HAS BEEN ADOPTED BY THE U. S. LIGHT-HOUSE BOARD FOR LIGHTING BUOYS.

Car Heating and Lighting Co.,

160 BROADWAY, NEW YORK.

WM. MARTIN, President.

FRANK E. SHAW, Vice-President and Treasurer.

W. E. CANDEE, Secretary.

THE MARTIN ANTI-FIRE CAR HEATER

NOW IN USE ON MORE THAN 3,500 CARS AND ENGINES.

ADOPTED ON

Roston & Albany Railroad,
New York Central & Hudson River
Lake Shore & Michigan Southern,
Michigan Central,
Cleve., Col., Cin. & Ind. "Bee Line,

Kings County Elevated,
Dunkirk, Allegheny Valley & Pittsburgh.
New York, Susquehanna & Western,
Cleveland & Canton,
West Shore,

Fall Brook Coal Co.,
Beech Creek Railroad,
Detroit, Lansing & Northern,
North. Cent. Div. of Pennsylvania System,
Union Pacific,

Buffalo, Rochester & Pittsburgh,
Providence & Worcester,
Long Island Railroad,
Elmira, Cortland & Northern R. R. Co.
Lehigh Valley,

AND IN USE ON MANY OTHER RAILROADS.

MANUFACTURERS OF

Martin's Combination Car Heater, DeKalb Ventilating Car Window, Automatic Car Light Extinguisher,
Automatic Steam Trap, Reducing Pressure and other Valves Especially
Adapted to Steam Car Heating.

WHOLESALE DEALERS IN BRASS AND IRON STEAM FITTINGS, STEEL AND WROUGHT IRON PIPE

MARTIN ANTI-FIRE CAR HEATER CO., DUNKIRK. N. Y.

ALBANY, N. Y.

936 BROADWAY.

New York City,

115 BROADWAY.

STEAM COUPLERS

AND
FIRE PROOF
HEATERS.

CONSOLIDATED

McElroy, Sewall, Westinghouse and other Patents.

CATALOGUES UPON APPLICATION.

Special Appliances and Extra Strong Fittings of Every Kind.

AUTOMATIC CONTROL OF HEAT.

CAR-HEATING CO.

CHICAGO;

200 PHENIX BLDG.

Canada,

COATCOOK, P. Q.

COMMINGLER,

DRUM,

AND
DIRECT STEAM
SYSTEMS.

E. G. KENLY, General Manager.

EUGENE CARRINGTON, Gen. Supt.

STORED HEAT IN EARTHENWARE TUBES.

MORTON SAFETY HEATING COMPANY.

BEING USED ON THE FOLLOWING ROADS:

Canadian Railroads:

Intercolonial.

Grand Trunk.



United States Railroads

Chicago, St. Paul, Min-
neapolis & Omaha.

Norfolk & Western.

Richmond, Fredericks-
burg & Potomac.

This system of heating is now in successful operation on the GRAND TRUNK and IN
TERCOLONIAL ROADS OF CANADA. NORFOLK & WESTERN, CHICAGO, ST. PAUL,
MINNEAPOLIS & OMAHA, RICHMOND, FREDERICKSBURG & POTOMAC, and ROAN-
OKE & SALEM ROADS, of the UNITED STATES.

ONE HEATING in the Coldest Climate keeps a train thoroughly comfortable for two
hours, and a pressure of steam afterward, of five minutes in each hour, is sufficient to main-
tain a uniform temperature of 70 degrees. No overheating and no cold cars. In case of acci-
dent there is absolutely NO DANGER OF FIRE, or injury from SCALDING, by escape of
steam.

Send for our new circular, showing winter tests and references. For full particulars of
cost of equipping trains address

MORTON SAFETY HEATING CO.,

N. Y. Office: Aldrich Court 45 Broadway. Baltimore Office: 106 E. Saratoga Street.

Field Engineering.

By Wm. H. REARLE

A hand-book of the Theory and Practice of Railway Surveying, Location and Construction.
Price, 25 cts.

THE PANCOAST PATENT

PASSENGER CAR VENTILATORS.

Strong Exhausts from the Impinge of the Outside Air,
and ABSOLUTELY ANTI-INGRESS.

NEW, NEAT, NOISELESS, SIMPLE and SCIENTIFIC.

Guaranteed to EXHAUST MORE THAN ANY OTHER Auto-
matic Car Ventilators, and to Be PERFECTLY STORM
AND DIRT-PROOF.

CAR VENTILATOR CO.,

DREXEL BUILDING, PHILADELPHIA, PA.

Road-Master's Assistant and Section-Master's Guide

By WM. S. HUNTINGTON.

Revised and enlarged by Chas. Latimer, Chief Engineer. A. & G. W. R. N., 300 pages, 50 illus.
Illustrations. Price \$1.50.

THE RAILROAD GAZETTE, 73 BROADWAY, N. Y.

THE ADDRESS PAINT AND COLOR COMPANY

MANUFACTURERS OF EVERY DESCRIPTION OF

RAILWAY AND MARINE PAINTS

15 CORTLANDT ST. NEW YORK

THE ALLISON MFG. CO.,

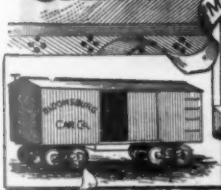
MANUFACTURERS OF

**FREIGHT CARS AND
LOCOMOTIVE BOILER TUBES,**
WROUGHT IRON PIPE OF SUPERIOR QUALITY.

PHILADELPHIA, PA.

**BLOOMSBURG
CAR CO.**

CARS FOR EXPORT
CONTRACTOR'S ROTARY
DUMP CARS.



G.M. LOCKARD.
J.K. LOCKARD.
R.W. OSWALD.

BloomSBurg, Columbia @ Pa.



ARE PREPARED TO BUILD
**Steel and Wooden
Freight Cars.**

Their repair plant is equipped with
modern appliances for

REPAIRING FREIGHT CARS

For Railway and Private Companies.

Special facilities for making all kinds of Car and Railway Forgings.

INQUIRIES SOLICITED.

DELIVERY UNSURPASSED.

T. W. HARVEY, Pres.

J. D. McILWAIN,

E. E. KAUFMAN, Sec. and Treas.

Gen'l Superintendent.

OFFICE:

825 The Hookery, Chicago.

WORKS: HARVEY, ILL.,

At Crossing Ill. Cent. and C. & G. T.

DELAWARE CAR WORKS.

JACKSON & SHARP COMPANY.

Manufacturers of Passenger, Sleeping, City, Baggage and Freight Cars.
WILMINGTON, DEL.

Cable address "Jackson." Special attention given to Sectional Work for
Exportation.

SOUTHERN & PACIFIC REFRIGERATOR CAR CO.

CRITT. A. COX, President.

E. D. LEACH, Secy. and Treas.

BUILDER OF THE
**SOUTHERN & PACIFIC
STANDARD REFRIGERATOR CAR.**

RIORDAN PATENTS.

The best Refrigerator Car now in use for Shippers of Dressed
Meats, Fruits, Dairy Products and Brewers.



GENERAL OFFICES:

SUITE 1307,

CHAMBER OF COMMERCE,
CHICAGO.

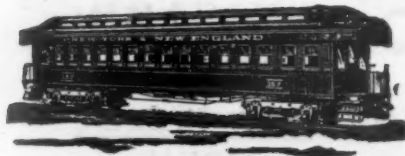
CORRESPONDENCE SOLICITED.

J. G. BRILL CO

PHILADELPHIA.

BUILDERS OF

Railway and Tramway Cars



THE ENSIGN MANUFACTURING COMPANY,

Manufacturers of **CARS** for Every Kind of
FREIGHT SERVICE.

Chilled Car Wheels of the Highest Grade only. Axles, Iron
and Brass Castings. Capacity: 20 Cars and
400 Car Wheels Daily.

We respectfully solicit your inquiries and specifications.

F. E. CANDA, President. C. J. CANDA, Vice-President. J. W. SAVIN, Gen. Agent.

11 PINE ST., NEW YORK.

E. ENSIGN, Secretary and Treasurer.

HUNTINGTON, WEST VIRGINIA.

CANDA MANUFACTURING COMPANY,

Manufacturers of **CHILLED CAR WHEELS**

OF THE HIGHEST QUALITY ONLY.

CAR SHOPS IN COURSE OF ERECTION.

OFFICES, No. 11 PINE STREET, NEW YORK CITY.

WORKS AT CARTERET, N. J.

CHARLES J. CANDA, President.
F. MORA CANDA, Treasurer.
FREDERICK HUDSON, Secretary.

FERDINAND E. CANDA,
JOHN W. SAVIN,
ELY ENSIGN, } Vice-Presidents.

YOUNGSTOWN CAR MFG. CO

Youngstown, Ohio.

RAILROAD FREIGHT CARS

L. E. COCHRAN, Pres.

B. F. BOYD, Sec'y and Treas.

ANDREW MILLIKEN, Gen. Man.

W. H. GLASGOW, President.
H. B. DENKER, Vice-President & Gen. Man.

ST. CHARLES CAR CO

MANUFACTURERS OF CAR WHEELS, STREET AND MOTOR CARS.

PASSENGER COACHES, BAGGAGE & MAIL CARS.

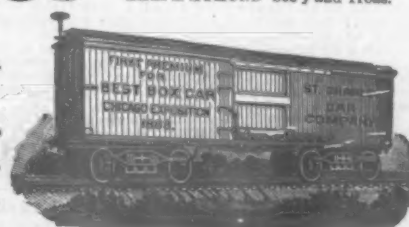


Box Cars,
Stock Cars,
Ore Cars,
Coal Cars,
Flat Cars,
Logging Cars,
Warehouse Trucks,



Refrigerator,
Excursion and
Caboose Cars,
Hand, Push and
Mining Cars,
Castings and
Forgings

ST. CHARLES, MO



WASON MANUFACTURING CO., SPRINGFIELD, MASS

Established 1845. Manufacturers of all descriptions of Railway Cars, Car and Locomotive Wheels, Frogs, Switches and Railway Castings. Employ none but Experienced Workmen, and
have on hand a Large and Complete Stock of Seasoned Lumber, sufficient for several years' consumption. Special facilities for furnishing Sectional Work for Exportation.

DAILY CAPACITY, ONE PASSENGER AND SIX FREIGHT CARS. SHIPMENTS MADE FROM NEW YORK OR BOSTON.

G. C. FISK, Pres't.
E. B. HYLER, Treas.

NEW WORKS BUILT 1872. P. O. ADDRESS, BRIGHTWOOD, MASS.



BRAKE



SHOES



CONGDON

Licensees of the **CONSOLIDATED BRAKE SHOE CO.,**

FOR OHIO AND WESTERN STATES: THE CONGDON BRAKE SHOE CO., Monadnock Building, Chicago, Ill.
 FOR OHIO AND EASTERN STATES: (CONGDON SHOES) RAMAPO WHEEL & FOUNDRY CO., Ramapo, New York.
 FOR OHIO AND EASTERN STATES: (FLANGE SHOES) RAMAPO IRON WORKS, Hillburn, New York.
 FOR SOUTHERN STATES: THE ROSS-MEEHAN BRAKE SHOE FOUNDRY CO., Chattanooga, Tenn.

Shoes should be ordered in accordance with the above allotment of territory.

THE LEADING CAR SEAT OF THE TIMES.Spring
Edge
Seat.

The following Popular Trains are furnished in whole or in part with our Superb Seating:

"Gilt Edge Limited."
 "Colonial Express" (Royal White Line).
 "Empire State Express."
 "Fast Flying Virginian."
 "Royal Blue Line."
 "Diamond Special."
 "Red Express."
 "Royal Reading Route."

SPECIFY ONLY

"H. & K."
SEATS.

"Flying Statesman."
 "New York and Chicago Limited."
 "Chicago and St. Paul Limited."
 "New Orleans and Chicago Limited."
 "Columbian Limited."
 "Chicago and Nashville Limited."
 "Golden Gate Special."
 "Washington and Southwestern Limited."

Head
Rest
Seat.**THE HALE & KILBURN MFG. CO.,**Philadelphia,
New York,
Chicago.**B ADLEY CAR WORKS, WORCESTER, MASS.**

ESTABLISHED 1893.

MANUFACTURERS OF EVERY DESCRIPTION OF

RAILWAY CARS.

OSGOOD BRADLEY & SONS, Proprietors.

The Jackson & Woodin Mfg. Co.,
BERWICK, PA.**FREIGHT CARS, CAR WHEELS, CAST IRON WATER AND GAS PIPE, CASTINGS AND FORGINGS.**C. R. WOODIN, Pres. C. H. ZEHRER, Vice Pres. and Genl. Manager.
WM. F. LOWRY, Treas. FRED. H. EATON, Secretary H. F. GLENN, Genl. Supt.**TUBULAR JOURNAL BEARINGS**

Enable railway cars to be started with but one-tenth the power required with ordinary brasses. Thirty (30) per cent. coal saving realized with trains of four or more cars. Journal heating entirely done away with by removing the cause. Cost of lubrication practically nothing, and every bearing guaranteed to yield 200,000 miles of service. Great economy and uniform reliability secured.

THE MENEELY BEARING COMPANY, West Troy N. Y.**Automatic Interchangeable Car Coupling Company,****[CALIFORNIA COUPLER,]**Solid Steel
OR
Malleable
Iron,
WITH
Steel Knuckle.Simplest,
Strongest
Best.F. L. WELLS, General Agent,
116 South Clinton St., Chicago, Ill.

(Home Office, San Francisco, Cal.)

DAVENPORT & FAIRBAIRN.**Chilled Iron Car Wheels.**

Capacity, 350 WHEELS PER DAY. ERIE, PA.

**MIDDLETOWN CARWORKS
RAILWAY and MINE CARS.**Works and office on main line Pennsylvania and Philadelphia & Reading
Railroads. Arthur King, Prop., Middletown, Pa.**Passenger Car Ventilator.**ALL CINDERS, DUST AND DIRT EXCLUDED.
A SUPPLY OF FRESH AIR GIVEN.**PERRY VENTILATOR CO.,**L. F. BRAINE, Gen'l Sales Agent,
Room 30, 115 Broadway, Boreel Building, New York**THE PARDEE CAR & MACHINE WORKS,**

WATSONTOWN, PA.

Manufacture Mail, Baggage, Box, Gondola, Flat, Gravel, Ore, Coal, Mine and
Hand Cars. Patent Turn-Tables and Centres for Wooden Turn-
Tables, Car Castings, Railroad Forgings, Rolling-Mill
Castings, Bridge Bolts and Castings.We have in connection with our Car Works an extensive Foundry and Machine Shop, and
are prepared to do a general Machine Business.
ARIO PARDEE, Proprietor. S. B. MORGAN, Manager.**The Car-Builders' Dictionary.**

BY A COMMITTEE OF THE MASTER CAR-BUILDERS' ASSOCIATION.

Revised by A. M. WELLINGTON, C. E.
The revised edition of 1885 is doubled in size and contains nearly three times as many engravings as were in the first edition. It has 2,188 engravings, including exact drawings of American Cars of every description, and of the different kinds of Trucks, Wheels, Brakes, Couplings, Seats, Lamps, Heaters, and all Car Furnishings in general use, in the minutest detail. All the detail drawings are made to scale, and each engraving is briefly described under the definition of its name. All terms in general use in Car-Building are defined, and a vocabulary of the leading terms used in English Railway Carriage and Wagon Construction is added. Price, \$3.00.
PUBLISHED AND FOR SALE BY THE RAILROAD GAZETTE, 73 BROADWAY, N. Y.**THE SURVIVAL OF THE FITTEST.****Van Dorston Cushioned Car Coupling Equipment Co.
VAN DORSTON CUSHIONED CAR COUPLER.**

M. C. B. TYPE.

Lightest, Strongest and Best. Automatic Self-Opening and Self-Adjusting. Insures
Safety to Trainmen. Independent Double-Acting Gravity Lock.
No Slack Required to Uncouple.Also the Van Dorston Single, Double and Triple-Acting Cushioned Draught
Gear. Seventy-five per cent. reduction in shocks on the part of the couplers and car
bodies, and consequent great economy in repairs. Increase in yard room of from 12 to
18 cars per 1,000. Correspondence respectfully solicited.**Van Dorston Cushioned Car Coupling Equipment Co.,** No. 305 Walnut St.,
Philadelphia, Pa.
EDWARD H. JOHNSON, President.

M. C. B. Standard
Automatic Freight Car Coupler.

New York Office: 120 BROADWAY.
Chicago Office: 941 ROOKERY
St. Louis Office: 319 COMMERCIAL BUILDING.

Gould Coupler Co.
Buffalo Office and Works,
AUSTIN ST.

Gould Continuous Platform and Buffer.
Gould Vestibule.

Locomotive and Car Axles,
Coupling
Links and Pins.

M. C. B. Passenger Coupler.
Used in Place of Miller Hook Without
Change in Platform.

W. A. ALEXANDER, President. H. O. NOURSE, Gen'l Agent. M. A. KILVERT, Sec'y.
A. C. MCCORD, Vice-President. D. W. MCCORD, Treas.

DREXEL

RAILWAY SUPPLY CO.

The DREXEL JOURNAL BOX LID

of Pressed Steel with a Central Bearing Spring. Cost of maintenance reduced to minimum with maximum efficiency.

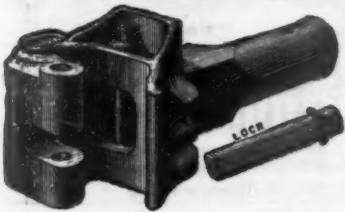
The Rookery, CHICAGO.
Eastern Office: COLUMBIA BUILDING, NEW YORK.

ST. LOUIS STEEL COUPLER,

FREIGHT, PASSENGER

AND

TENDER COUPLERS.



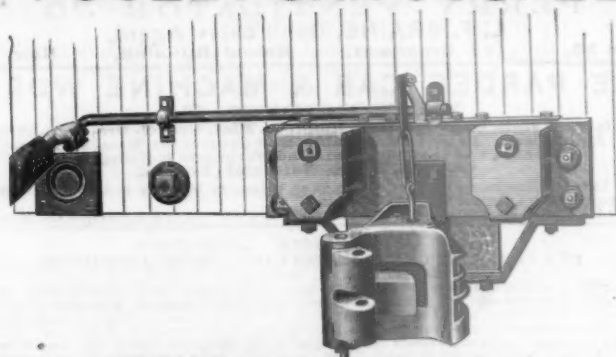
ST. LOUIS CAR COUPLER CO.,
ST. LOUIS, MO.

WM. V. WOLCOTT,
President.

HENRY O'HARA,
Vice-Prest.

GEO. A. BANNANTINE,
Secretary.

THE POOLEY CAR COUPLER.



Positively Automatic.
COMPLYING FULLY WITH ALL REQUIREMENTS OF THE LAW.
SIMPLE STRONG. EFFECTIVE.
PRATT & LETCHWORTH, MANUFACTURERS, BUFFALO, N. Y.

McGILL THE VERTICAL PLANE MUST GO SETTLES THE QUESTION.

World's Fair
Freight Passenger CAR COUPLERS.
McGILL IRON WORKS CO. PEORIA, ILL.

See the other ad.

PASSENGER,
FREIGHT,
TENDER.

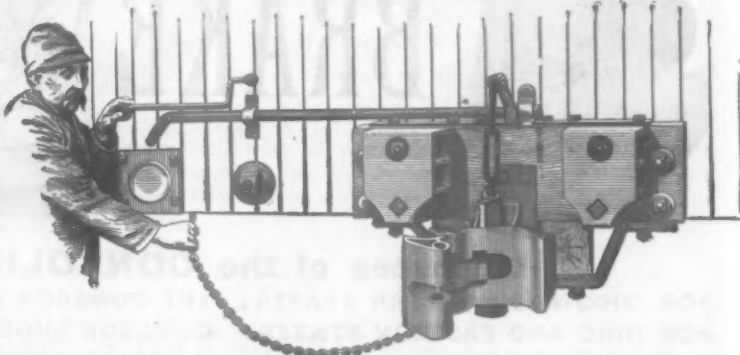
HINSON COUPLERS

The
Hinson Car Coupler Co.,
518 Rookery, Chicago.
31 & 33 B'way N. Y.

STANDARD COUPLER.

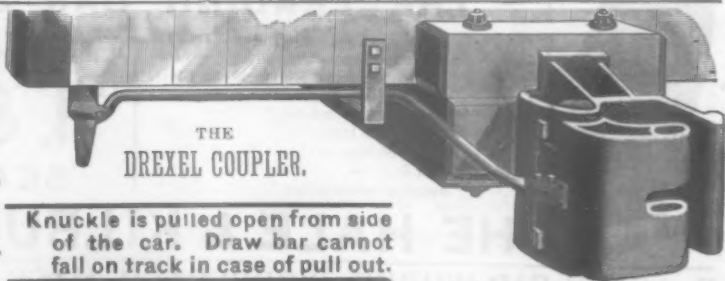
(DOWLING TYPE.)

Drawhead. Malleable Iron; Knuckle, Pressed Steel; Pin, Drop Forged Steel.



With Chain Attachment for Opening the Knuckle WHEN REQUIRED.

THE STANDARD CAR COUPLING CO.,
New York Office, 45 Broadway. Chicago Office, 1018 The Rookery.



THE
DREXEL COUPLER.

Knuckle is pulled open from side of the car. Draw bar cannot fall on track in case of pull out.

SMILLIE DOUBLE LOCK COUPLER.



TENSILE STRENGTH (Fairbank's Test) 139,640. **DROP TEST,** 700 lbs. hammer dropped 18 ft. 22 times failed to break the knuckle.

Direct drop of full sized pin makes a double lock formed by draw bar at "C" and Pin "D." Equally strong if pivot pin "A" is lost. Should pin be lost, use any link—no chains being required. The strongest Knuckle and Coupler known. Cannot be unlocked by any jolt of the cars. Couples with all M. C. B. types. The locking pin drops behind the step on rear of Knuckle "K" and keeps the knuckle always open when cars are separated. Removing the pivot pins, 33 loaded gondola cars were drawn from Paterson, N. J., to West End (18 miles), the pull being entirely on the DOUBLE LOCK.

The drawbar is Malleable Iron. The Knuckle Pivot and Locking Pins steel.

THE SMILLIE COUPLER & MFG. CO.,

52 Broadway, New York. Works, 91 Clay St. Newark, N. J

TROJAN CAR COUPLER.

M. C. B. TYPE.

THE STRONGEST AND THE ONLY SAFETY COUPLER.



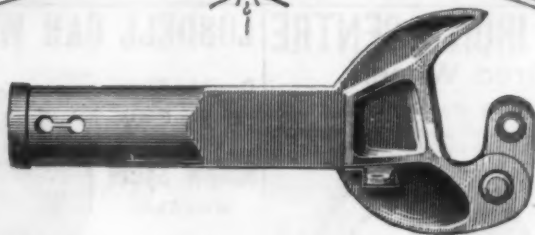
If the knuckle may be thrown open for coupling by the hand-rod at the side of the car, rendering unnecessary for trainmen to go between the cars to open the knuckle. The action is positive, and not dependent on springs or gravity.
The lock has a bearing of four square inches on the knuckle.
N. O. Olsen, Engineer of Fairbanks & Co.' testing department, says: "IT IS THE STRONGEST COUPLER NOW IN THE MARKET"

THE TROJAN CAR COUPLER CO.,

New York Office, 11 Pine street.

TROY, N. Y

THE JANNEY FREIGHT CAR COUPLER



THE MC CONWAY & TORLEY CO.

W. MC CONWAY.

© PRESIDENT. ©

48th ST. & A. V. R. R. PITTSBURGH, PA.

Agents & Manufacturers For

THE JANNEY-HIEN COMPANY

THE BUCKEYE COUPLER.

W. F. GOODSPEED, President.

R. M. ROWND, Vice-President.

S. P. PEABODY, Secretary and Treasurer.

Master Car Builders' Standard in every particular. Combines the greatest obtainable strength and simplicity. Only Three Parts. Positive acting gravity lock and positive mechanical opening of knuckle. Absolute Central draft. Same movement that raises the lock throws open the knuckle.

Adopted as Standard by Several Leading Railroads After Severe Tests and Long Trials.



*Sold with a GUARANTEE
to Stand the Proposed
M. C. B. Drop and
Pulling Tests.*

E. J. EAMES, Western Agent,
Phoenix Building, CHICAGO, ILL.

THE BUCKEYE AUTOMATIC CAR COUPLER CO., Columbus, Ohio.

JOHNSTON CAR COUPLING COMPANY

204 WALNUT PLACE, PHILADELPHIA, PA.



The Lightest, Simplest and Least Expensive Coupler in the Market.

WEIGHT 180 POUNDS.

MEETS ALL THE REQUIREMENTS OF THE M. C. B. LINES AND TESTS.

LOCKING DEVICE SIMPLE, DURABLE AND EFFECTIVE.

It Has but Four Parts and Cannot Be Opened by Accident.

KNUCKLE OPENS AUTOMATICALLY.

THE BALTIMORE CAR WHEEL COMPANY

MANUFACTURERS OF

CHILLED WHEELS OF ALL PATTERNS AND SIZES FOR EVERY SERVICE, AND WITH OR WITHOUT AXLES.
CAPACITY, 400 WHEELS PER DAY.

W. S. G. BAKER, President and Treasurer.
J. PAUL BAKER, Secretary.

OFFICE AND WORKS: Fulton Junction, Baltimore, Md.

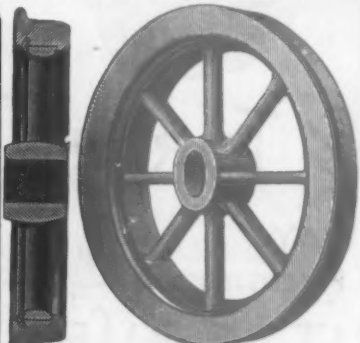
COCKERILL'S WROUGHT IRON CENTRE Spoke and Disc Steel Tired Wheels,

OF AMERICAN STANDARD.

For Locomotive Driving Wheels, Locomotive Tender and Truck Wheels and Passenger Car Wheels.



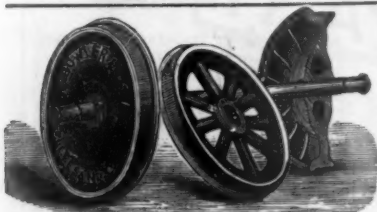
Fourteen years of constant service on the Pennsylvania R. R., and over 25 years of service on the most important roads of Europe is the record of our wheels.



Gibson Fastening.

Mansel Retaining Rings or Gibson Fastening.
Adopted as Standard Wheel on some of the Principal Roads in this country. Apply for Catalogue.

CHAS. G. ECKSTEIN & CO., Sole Agents,
41 John St., New York.



BOWLER & COMPANY,

Nos. 10 to 24 Winter St., CLEVELAND, O.

MANUFACTURERS OF

Car Wheels of all Kinds and
Sizes, with or with-
out axles.

Railroad Building and Heavy Castings
A SPECIALTY.

THE KRUPP SYSTEM OF AMERICAN STANDARD STEEL-TIRED WHEELS

CAST-STEEL WORKS

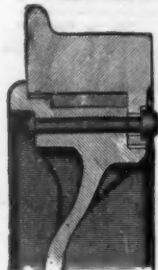
Of FRIED. KRUPP, Essen, Germany.

REPRESENTED BY

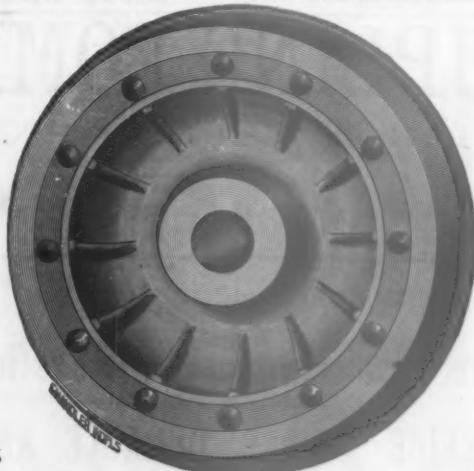
THOMAS PROSSER & SON

15 Gold Street, New York.

CUSHION CAR WHEEL



RECORD 40,000 MILES.
1-16 INCH WEAR.



Simplicity.

Durability.

Economy.

Elasticity.

Safety.

Noiseless.

For Coaches, Locomotives and Tender Trucks on Elevated, Electric and Street Railroads. Two pieces only. Centre never removed from axle. Tire renewed in any shop. Cushion absorbs all vibrations or undue stress and thrusts. One-half more mileage than any other wheel made.

SEND FOR CIRCULAR.

CUSHION CAR WHEEL CO., (INDIANAPOLIS, IND., and
GRAND PACIFIC HOTEL, CHICAGO.)

LOBDELL CAR WHEEL CO., WILMINGTON, DEL.

Established 1836.

Double Plate,
Single Plate

AN

Hollow Spoke
WHEELS

FOR
Broad and Nar-
row-Gauge Cars
Engines and Ten-
ders.



Also
OPEN AND
Solid Plate
STREET CAR
WHEELS

Either in the
Rough or Fitted
on Axles.

CAPACITY, 500 WHEELS PER DAY.

TAYLOR IRON & STEEL CO.

SUCCESSORS TO "THE TAYLOR IRON WORKS,"

HIGH BRIDGE, NEW JERSEY, on line of C. R. R. of N. J.

NEW YORK OFFICE: ROOM 505 CENTRAL BUILDING, LIBERTY AND WEST STS.



—MANUFACTURERS OF—

Steel Tired Car Wheels, Chilled Iron Car Wheels, Car and
Locomotive Axles, Iron and Steel Forgings.

PITTSBURGH FORGE AND IRON COMPANY

CALVIN WELLS, Pres. & Treas.

MANUFACTURERS OF

F. E. RICHARDSON, Secy.



MERCHANT IRON,

Draw-Bars, Links and Pins, Follower Plates, Railroad Forgings, Arch Bars, Splice Bars,
Track Bolts, Bridge Rods, with Plain or Upset Ends, All Sizes.

Office: Tenth Street, near Penn Avenue, Pittsburgh, Pa.



THE
Standard
Steel Works,
MANUFACTURERS OF
Locomotive and Car-Wheel
TIRES.

OFFICE: 220 SOUTH FOURTH ST.
Philadelphia, Pa.

LATROBE STEEL WORKS

MANUFACTURERS OF

TIRES

FOR LOCOMOTIVE AND CAR WHEELS.

Works and Main Office, Latrobe, Pa.

Branch Office, 251 S. 4th St., Philadelphia





10 WALL ST., NEW YORK
237 FRANKLIN ST., BOSTON
719 PHOENIX BUILDING, CHICAGO

FRANK S. LAYNG, CHAIRMAN.

C. R. KEARNS, SECRETARY AND TREAS.

PICKERING SPRING CO., Limited

MANUFACTURERS OF

Railway Springs of Every Description

PHILADELPHIA

THE WASHBURN CAR-WHEEL COMPANY

HARTFORD, CONN.



**CRUCIBLE
STEEL-TIRED WHEELS,**
For Parlor and Sleeping Cars,
Passenger Coaches, Locomo-
tive and Tender Trucks.

CAST-IRON CENTRES

WELDED TO
Hammered & Rolled Crucible Steel Tires.

THE CAYUTA WHEEL AND FOUNDRY CO
AND SAYRE STEAM FORGE

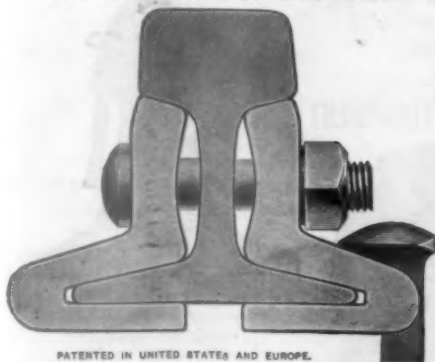
MANUFACTURERS OF

**WHEELS
AND
AXLES**



For Locomotives, Tenders, Passenger and Freight Cars.
RAILROAD CASTINGS AND HEAVY FORGINGS.
HOWARD ELMER, Pres. F. E. LYFORD Treas. M. C. CHAPMAN, Supt.
SAYRE PA.

**The Coming Joint for Steam Railroads,
ELECTRIC and CABLE STREET RAILWAYS.**
IN SUCCESSFUL USE ON 48 ROADS.



PATENTED IN UNITED STATES AND EUROPE.

CONTINUOUS RAIL JOINT COMPANY OF AMERICA,
Broad and Market Sts., Newark, N. J.

By its use the rail is made as strong at the joint as it is at the centre of the rail as it lies in track.

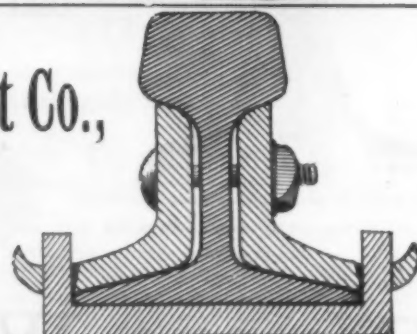
It is simple and easily applied, and has always given satisfactory results.

It is the safest joint to use, and cheaper in the long run than the angle bar.

It will increase the life of the rail over 25 per cent.

Eno Rail Joint Co.,

NEWARK, N. J.

**THE HINCKLEY AUTOMATIC BRAKE-SLACK ADJUSTER**

Simple. Compact. Effective.



Piston of Air Brake Cylinder is automatically kept at any desired uniform stroke, resulting in full, effective piston pressure at all times.

ONE ADJUSTER PER CAR.

Uniformly applicable to any form of brake rigging, Passenger or Freight, whether brakebeams are outside or inside hung, etc., etc.

Illustrated Catalogue, with records of performance in service, upon application.

THE HINCKLEY BRAKE COMPANY, TRENTON, NEW JERSEY.

THE JERSEY CITY WHEEL FOUNDRY AND MACHINE WORKS
HIGH GRADE CHILLED CAR WHEELS
ALL WHEELS GUARANTEED TO STAND 200,000 MILES

American Steel Wheel Co.,

JNO. C. PAUL, President.
J. H. OLHAUSEN, Vice-Prest.
G. W. CUSHING, Superintendent.
SAM'L GARWOOD, Secretary and Treasurer.

—MANUFACTURERS OF—

Solid Steel Double Plate or Spoke Locomotive Truck, Tender, Passenger and Fast Freight Wheels, turned on tread and flange and balanced, on which we give a Mileage Guarantee.

Solid Steel Castings for Railroad Equipment generally, Miller Hooks, Buffers, Levers, Crossheads, Rockers etc., and Knuckles for repairing M. C. B. Drawheads.

This metal is acknowledged by R. R. officials to be especially adapted for Knuckles, owing to its superior strength and ductility.

Correspondence Solicited.

New York Office: . . . Central Building, 143 Liber'y St.

NEW DEPARTURE IN RATCHET DRILLS**SCHUTTLE MFG. CO.**

FRANK BAKEMAN & CO., 8 Rotunda, Rookery, Chicago, GENERAL AGENTS.
AVERY & WEST, 450 Rookery, Chicago, WESTERN AGENTS.

The movement of the handle in either direction causes a continuous drilling, thus doing the work in half the time of any other ratchet drill without additional labor. The drill is strong, durable and easily operated, the working parts being completely protected from dust and weather.



THE FONTAINE CONTINUOUS RAIL CROSSING

(FOR DESCRIPTION SEE RAILROAD GAZETTE OF DEC. 18, 1891)

**THE MOST ECONOMICAL. ABSOLUTE SAFETY.
HIGH RATE OF SPEED WITHOUT ANY JAR.**

CHICAGO OFFICE:

Room 320, Home Insurance Office, 205 La Salle Street.

NEW YORK OFFICE:

Room 615, Mutual Life Building, 32 Nassau Street.

WORKS AND MAIN OFFICE:

**FONTAINE CROSSING CO., DETROIT, MICH.
THE STANDARD COMBINATION TIE PLATE AND BRACE**

POSSESSES THE FOLLOWING MERITS:

1. It prevents absolutely the canting of the rail into the tie, thereby greatly increasing the life of the tie.
 2. It prevents the rails from spreading or canting over and wearing one side only.
 3. The combination of the brace and plate obviates the necessity of spiking the rail and brace separately, thereby saving two spikes and securing the service of the inside spike for holding the rail; it also prevents the rail from working up and down, and laterally, thus making it impossible to wear the neck of the spike.
 4. The plate and brace being made of malleable iron, is practically indestructible.
- The tie plate and brace is especially useful for curves and guard rails, and also on bridges, whether the rail is laid on ties or on stringers. A tie plate without a brace will not save the head of the spike. A brace without a tie plate will not save the tie, and in a short time the rail will wear into the tie.

P. O. Box 288, PHILADELPHIA, PA.

WILLIAM H. PHILLIPS.

Boughton's Safety Car Seal

IS THE ONLY CAR SEAL RECOGNIZED BY THE
UNITED STATES & ENGLISH GOVERNMENTS
BUFFALO SEAL & PRESS CO. BUFFALO, N. Y. U.S.A.

D. A. HOPKINS MFG. CO. LEAD-LINED JOURNAL BEARINGS AND BRASS CASTINGS.
CENTRAL BUILDING 143 LIBERTY ST., N. Y.

RAMAPO IRON WORKS

HILLBURN ROCKLAND COUNTY, N. Y.

MANUFACTURERS OF

Switches, Automatic Safety Switch Stands, Yoked Frogs
Bolted Plate and Spring Rail Frogs, Automatic
Distant Signals Interlocked with Switches,
Crossings of Every Description.

LIGHT AND HEAVY CASTINGS AND GENERAL TRACK EQUIPMENT



Automatic Stand, Showing Position
of Parts while being Thrown
by Hand.



RAMAPO "YOKED FROG."



Automatic Stand, Showing
Position of Parts while
being Thrown Au-
tomatically by
Train.

Ramapo Wheel & Foundry Company

MANUFACTURE

CHILLED IRON CAR WHEELS

FROM SPECIAL QUALITY CHARCOAL IRON

FOR

Drawing Room and Sleeping Coaches, Lo-
comotives, Tenders and Passenger
and Freight Cars.

Congdon Brake Shoe.

Bacon Journal Box.



For
DRIVERS
CAR WHEELS
STEEL TIRED & CHILLED

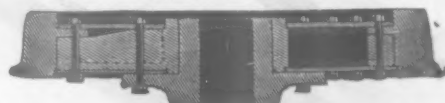
BRAKE SHOES
FOR
OHIO & WESTERN STATES
MADE BY
CONGDON BRAKE SHOE CO.
CHICAGO ILL.
FOR
OHIO & EASTERN STATES.
ROSS-MEEHAN SHOES
MADE BY
RAMAPO IRON WORKS

FOR
CHILLED IRON
CAR WHEELS

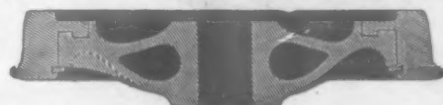
Snow's Rigid Steel-Tired Wheels,

WITH TIRES HAVING ANNULAR WEBS.

BOLTED--WITH WROUGHT-IRON PLATES, CAST-IRON CENTRE
AND INTERCHANGEABLE HUB.



BOLTLESS--WITH CAST-IRON DOUBLE PLATE OR SPOKE CENTRE
AND WEDGE-SHAPED RETAINING RING.



Both of these Wheels can be Re-tired in any Ordinary Machine Shop

OFFICE AND WORKS, RAMAPO, N. Y.

DON'T MAKE MISTAKES,
but patronize the Electric Lighted, Steam
Heated Vestibuled Trains of the
Chicago, Milwaukee & St. Paul Railway.



Through cars between Chicago and Portland, Oregon, via St. Paul & Nor. Pac. R. R., and through cars between Chicago and Denver, Colo., via Omaha and the B. & M. R. R. For further particulars apply to nearest Ticket Agent or address: GEO. H. HEAFFORD, Gen'l Pass'r Ag't, CHICAGO, ILL.



between **CHICAGO** and
New York, Boston and the East.

NEW YORK & NEW ENGLAND R. R. New York and Boston Trains

Leave either city.....12:00 m. 3:00 p. m.
Arrive at terminus.....6:30 p. m. 8:40 p. m.

TICKET OFFICES:
Grand Central Station, New York; 322 Wash-
ington Street, Boston.

3:00 p. m.—The "White Train."—Runs daily,
including Sundays.

NOTE.—On Sunday the White Train arrives
Boston and New York at 9:00 p. m.

Parlor and Dining Cars

TRAVEL VIA THE



TO ALL

**POINTS WEST,
NORTHWEST,
and SOUTHWEST.**
P. S. EUSTIS, Gen. Pass'r and Ticket Agent
CHICAGO, ILL.



4 DAILY TRAINS 4
ST. LOUIS TO KANSAS CITY.
THE COLORADO SHORT LINE TO PUEBLO AND DENVER
EQUIPPED WITH PULLMAN BUFFET SLEEPING CARS.
IRON MOUNTAIN ROUTE. 3 DAILY TRAINS 3.
To Texas and the Southwest. The Shortest and Quickest Line to the City
of Mexico, with only one change at Laredo.
ONLY ONE CHANGE OF CARS ST. LOUIS TO SAN FRANCISCO.
S. H. H. CLARK, H. C. TOWNSEND,
1st V.-Pres. & Gen'l. Mangr. Gen'l. Pass'r. and Ticket Agent

PENNSYLVANIA RAILROAD.

**GREAT TRUNK LINE AND UNITED STATES MAIL ROUTE. THE
BEST CONSTRUCTED AND MOST COMPLETELY EQUIPPED
RAILWAY IN AMERICA.**

Connecting all the principal cities on the Atlantic coast with those in the Mis-
sissippi Valley and on the Great Lakes. Through trains with Pullman
Vestibule Cars attached, between New York, Philadelphia, Washington and
Baltimore and Chicago, St. Louis, Cincinnati and Louisville.

Passage Checked to Destination. Fare always as low as by any other route.
For tickets, palace and parlor car accommodations, and all desired information, apply at the
offices of the company: No. 205 Washington street, Boston; No. 1 Astor House, Nos. 435, 849
and 944 Broadway, and Desbrosses and Cortlandt street, New York; Nos. 808 and 1348
Chestnut street, and Broad Street Station, Philadelphia; N. E. corner Baltimore and Calvert
streets, Union Station and Northern Central Railway Station, Baltimore; N. E. corner
thirteenth street and Pennsylvania avenue, and Baltimore and Potomac Railroad Station,
Washington City.

CHAS. E. PUGH, General Manager.



OVER 7,000 MILES
Of steel track in Illinois, Iowa,
Wisconsin, Michigan, Minnesota,
Nebraska, Dakota and Wyoming,
penetrates the Agricultural, Mining
and Commercial Centres of the
WEST and NORTHWEST
The Unrivalled Equipment of the
Line embraces Sumptuous Dining
Cars, New Wagner and Pullman
Sleepers, Supurb day Coaches and
FAST VESTIBULED TRAINS

Running direct between Chicago,
St. Paul and Minneapolis, Council
Bluffs and Omaha, connecting for
Portland, Denver, San Francisco
and all Pacific Coast Points.

ONLY LINE TO THE BLACK HILLS

For Tickets, Rates, Maps, Time Tables and
full information, apply to any Ticket Agent or
address the Gen'l. Passenger Agent, Chicago, Ill.
J. M. WHITMAN, H. C. WICKER, W. A. TEEBAL,
General Man. Traffic Man. & T. A.

"SPRINGFIELD LINE" Limited Trains

—LEAVE—

BOSTON and NEW YORK

—AT—

12:00 NOON, DUE 5:40 P. M.

—ONLY—

5 Hours and 40 Minutes.

The equipment of above trains will consist
of baggage car, drawing room smoking car
and two drawing room cars.

FARE \$6.00.

Including seat in drawing room car.

Tickets will not be sold beyond the seating
capacity of the train.

A. S. HANSON,
General Pass. Agent.

Hoosac Tunnel Route FITCHBURG RAILROAD.

Short line between the East and West. Sleep-
ing and drawing-room cars on all express
trains.

J. R. WATSON,
General Passenger Agent.

Machinery for Coaling Locomotives.

Before you forget it, send for Catalogue
No. 7 to

C. W. HUNT CO.,
45 BROADWAY, NEW YORK



SOLID TRAINS —BETWEEN— NEW YORK AND CHICAGO, Via Chautauqua Lake or Niagara Falls.

An Enchanting Panorama of Mountains
Forests and Streams.

PULLMAN CARS

Between New York and Rochester, Buffalo
Niagara Falls, Toronto, Chautauqua Lake,
Cleveland, Cincinnati and Chicago.

D. I. ROBERTS, Gen'l Pass. Agt.

Short and Direct Through Car Line

BETWEEN

CINCINNATI, INDIANAPOLIS AND CHICAGO.

Private Compartment Buffet Sleeping Cars, Standard Wagner Palace Sleeping Cars and
Elegant Reclining Chair Cars on Night Trains; Luxurious Parlor and Cafe Dining Cars on Day
Trains.

THE SOUTHWESTERN LIMITED,

FROM ST. LOUIS, INDIANAPOLIS AND CINCINNATI
TO NEW YORK AND BOSTON.

is the finest train in America, and provides the best and quickest service ever offered between
the East and the West, landing passengers in the heart of New York City without ferry trans-
fer.

OSCAR G. MURRAY, Traffic Manager, D. B. MARTIN, Gen. Pass. Agt.,
CINCINNATI, O.

CHICAGO & ALTON RAILROAD.

Ladies Palace Day Cars and Palace Reclining Chair Cars Free of Extra
Charge, Pullman Palace Buffet Compartment Sleeping Cars,
and Palace Dining Cars.

PULLMAN VESTIBULED TRAINS

Free of Extra Charge, and no Change of Cars of any Class Between
CHICAGO AND KANSAS CITY, CHICAGO AND DENVER

CHICAGO AND ST. LOUIS, and ST. LOUIS AND KANSAS CITY.

Pioneer Pullman Palace Sleeping Car, Palace Dining Car, and
Free Palace Reclining Chair Car Line.

JAMES CHARLTON, General Passenger and Ticket Agent,
210 Dearborn Street, Corner Adams Street. CHICAGO, ILL.

NEW YORK CENTRAL & HUDSON RIVER R. R.

THE GREAT FOUR-TRACK TRUNK LINE OF AMERICA.

All through trains arrive at and depart from Grand Central Station, Fourth
Ave. and 42d Street, New York, the very centre of the city.

THE DIRECT LINE BETWEEN NEW YORK AND NIAGARA FALLS

Wagner Palace Sleeping and Drawing-Room Cars on all through trains.
JOHN M. TOUCHEY, GEO. H. DANIELS,
General Manager. General Passenger Agent.

ILLINOIS CENTRAL RAILROAD.

Through Line of Free Reclining Chair Cars and Pullman
Palace Sleepers between Chicago and St. Louis. Direct
Connection in Union Depot for all points diverging

The SHORTEST ROUTE from CHICAGO TO CAIRO, MEMPHIS
and NEW ORLEANS, making DIRECT CONNECTION for LITTLE
ROCK, HOT SPRINGS, FT. WORTH and ALL POINTS in ARKAN-
SAS and TEXAS; also for NASHVILLE, CHATTANOOGA, VICKSBURG, MOBILE, and
ALL POINTS SOUTH and SOUTHEAST.

Through Train of Free Reclining Chair Cars and Pullman Palace Sleepers
between Chicago and Springfield.

The SHORTEST and MOST DIRECT ROUTE from CHICAGO TO ROCKFORD, DUBUQUE,
WATERLOO, CEDAR FALLS, SIOUX CITY, SHELTON, ROCK RAPIDS and SIOUX
FALLS, making DIRECT CONNECTION at SIOUX CITY with UNION PACIFIC RAILWAY
for ALL POINTS in NEBRASKA, COLORADO, UTAH, WYOMING and THE PACIFIC
COAST.

For Tickets, Rates and all information apply to any Coupon Ticket Agent in the United
States or Canada, or address
T. J. HUDSON, Traffic Manager. A. H. HANSON, General Passenger Agent

General Freight Department.

THROUGH LINE WITHOUT TRANSFER OF FREIGHT

To principal points in Illinois, the West and Northwest;
also to New Orleans, Memphis and points in the
South, Southeast, Texas and Mexico.

HORACE TUCKER, General Freight Agent,
Chicago, Ill.

THE GREATEST THROUGH CAR LINE

BETWEEN THE EAST AND WEST.

Wagner Sleeping, Drawing Room and Private Compartment Cars between
New York, Boston, Albany, Buffalo, Cleveland, Toledo, Chicago, Cincinnati and
intermediate cities.
Route of the New York and Chicago Limited, Boston and Chicago Special and
U. S. Fast Mails.

ONLY DOUBLE-TRACK LINE TO WORLD'S FAIR.

W. H. CANNIFF, Gen. Supt., Cleveland, O.

A. J. SMITH, G. P. & T. A.

THE FINEST ON EARTH.—The Cincinnati, Hamilton & Dayton, R. R.
is the only line running Pullman's Perfected Vestibule Trains, with chair
parlor, sleeping and dining-car service between Cincinnati, Indianapolis
and Chicago, and is the only line running through reclining-chair cars
between Cincinnati, Keokuk and Springfield, Ill., and combination chair
and sleeping-car Cincinnati to Peoria, Ill., and the ONLY DIRECT LINE
between Cincinnati, Dayton, Lima, Toledo, Detroit, the Lake Regions and
Canada. The road is one of the oldest in the State of Ohio and the only
line entering Cincinnati over 25 miles of double track, and from its past
record can more than assure its patrons speed, comfort and safety. Tick-
ets on sale everywhere, and see that they read C. H. & D., either in or out of Cincinnati, Indian-
apolis or Toledo. E. O. MCCORMICK, Gen. Pass. and Tkt. Agent.

THE RAILROAD GAZETTE

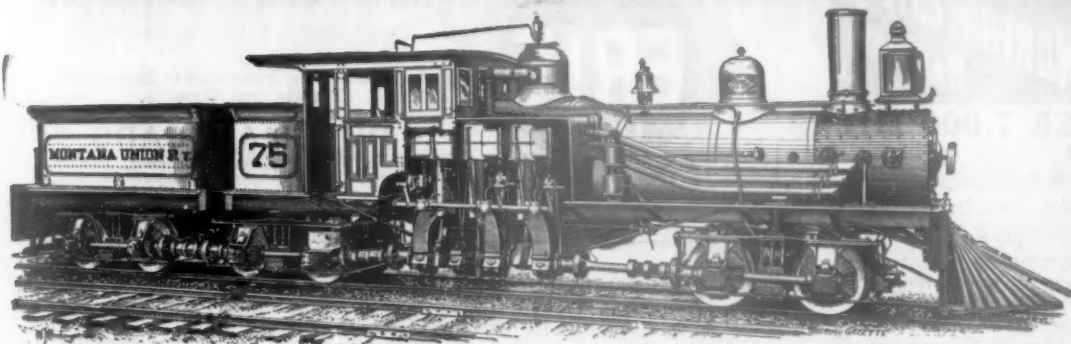
has more Railroad Officers as subscribers and readers than all
other railroad papers combined. Its advertising rates are no
higher than those of papers having less than half its circulation

J. R. WOOD, General Passenger Agent,

J. C. HENDRICKSON,
F. J. CLAYTON,
Co-Partners.

AJAX BEARINGS DON'T GET HOT.

AJAX METAL CO.
Philadelphia, Pa.



LIMA MACHINE WORKS, LIMA, O., U. S. A.,

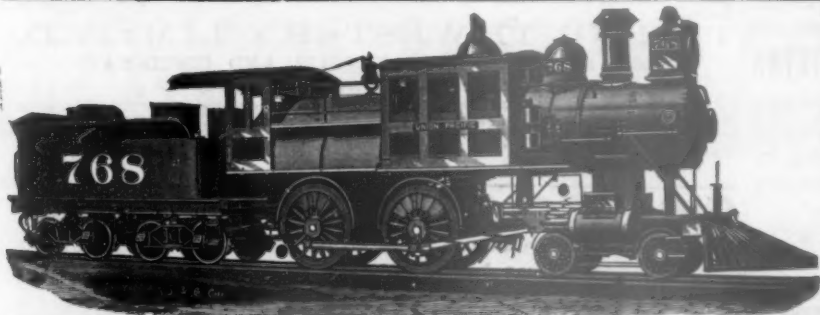
SOLE MANUFACTURERS OF THE

Shay Patent Locomotive Engines,

Built to weigh from 7 tons up to 90 tons on drivers and are especially adapted for service on roads where there are heavy grades and sharp curves. These locomotives are working successfully on grades of 9 1/2 per cent., and on curves of 100 feet radius. We also build

Standard Types of Light Locomotives,
Mining Cars of all Kinds,
CAR WHEELS AND AXLES.

Write for Particulars.



WOOTEN LOCOMOTIVE

MECHANICAL AND ELECTRIC

INTERLOCKING AND BLOCK SIGNAL SYSTEMS.

Every Variety of Track Supplies. Heavy Tools.

MACHINISTS AND MANUFACTURERS.

THE WHARTON RAILROAD SWITCH CO.

125 South Fourth Street, Philadelphia, Pa.

PORTLAND CO., LOCOMOTIVES AND CARS.

PORTLAND, MAINE.

FRANKLIN C. PAYSON, President.

JAMES E. GREENSMITH, General Manager.

BYRON D. VERRILL, Treasurer.

H. K. PORTER & CO
Pittsburgh, Pa.

LIGHT LOCOMOTIVES

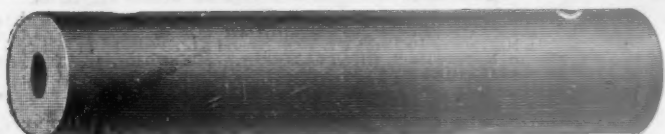
And Noiseless Street Motors.

And for all gauges of track. All work steel fitted and interchangeable. Duplicate parts kept in stock. Illustrated Catalogue mailed on application.



This cut changed weekly.

FALLS HOLLOW STAYBOLT CO.,



CUYAHOGA FALLS, O.

Rolled Hollow Staybolts Are Stronger and Safer than Drilled Ones. Mandrel rolled from the finest charcoal iron. All sizes, from 3/8 to 1 1/2 inch, with any sized hole required from 1/8 to 3/4 inch. Let us send you a sample and quote prices.

A set for one firebox will convince you of their merits, safety and economy.

IMPROVED LOCOMOTIVE STEAM GAUGE



SPRINGS MADE FROM

Special Seamless Drawn Tubing

The ONLY Locomotive Steam Gauge made where the Movement, Springs and all Moving Parts are Detached from the Back of the Case.

Case Fitted with our Patent Elastic Packing to Prevent Dust and Moisture from Entering Gauge.

The Ashcroft Mfg. Co.

Factory, Bridgeport, Conn. Office, 111 Liberty Street, New York City.

FULLER BROTHERS & CO

139 GREENWICH STREET, NEW YORK.

SOLE AGENTS FOR

DOVER IRON CO. OF NEW JERSEY.

BOILER RIVETS, BRACE JAWS, STAY BOLT IRON

ALSO

NUTS, BOLTS AND WASHERS.

RHODE ISLAND TOOL CO.,

Cold Punched Square and Hexagon Nuts.

(Chamfered and Trimmed with Drilled Holes).

Finished Case-Hardened Hexagon Nuts.

Engineers' Steel Wrenches.

Machine Bolts.

Rough and Milled Studs.

Cap and Set Screws.

Turn Buckles.

Drop Forgings to Order.

PROVIDENCE, RHODE ISLAND.

RICHARDSON & ALLEN-RICHARDSON BALANCED SLIDE VALVES.

NEW PATENT APRIL, 1891.

6,000 Locomotives Equipped. In use on 175 Railroads.

MANUFACTURED ONLY BY

M. C. HAMMETT,

SUCCESSOR TO

ESTATE OF F. W. RICHARDSON, TROY, N. Y.

U. S. METALLIC PACKING CO.,

485 NORTH BROAD STREET, PHILADELPHIA, PA.

Saves \$24 per Year per Engine, as Compared with Fibrous Packing.

IN USE ON 245 RAILROADS OF THE WORLD.

THOMAS PROSSER & SON
16 Gold Street, New York.

KRUPP'S STEEL TIRES

On Locomotive Driving Wheels.
GIVE THE BEST RESULTS
For Every Variety of Service.

BALDWIN LOCOMOTIVE WORKS,
ESTABLISHED 1831.
ANNUAL CAPACITY, 1,000.



COMPOUND LOCOMOTIVES

And Locomotives adapted to every variety of service, and built accurately to standard gauges and templates. Like parts of different engines of same class perfectly interchangeable. Broad and Narrow Gauge Locomotives; Mine Locomotives by Steam or Compressed Air; Plantation Locomotives; Furnace Locomotives; Noiseless Motors for Street Railways, etc.

BURNHAM, WILLIAMS & CO., Proprietors, PHILADELPHIA, PA.

ESTABLISHED IN 1865.

Richmond Locomotive & Machine Works,
RICHMOND, VIRGINIA,



Builders of LOCOMOTIVES for all classes of service to standard designs and specifications.

DICKSON MANUFACTURING CO.

BUILDERS OF

Standard and Narrow-Gauge LOCOMOTIVES.

Scranton, Pa.

JAS. P. DICKSON, President
SIDNEY BROADBENT, Gen'l Supt.

WM. H. PERKINS, Secretary and Treasurer.
JOHN DEVINE, Superintendent.

EDWARD ELLIS, Pres. WALTER McQUEEN, V. Pres. WM. D. ELLIS, Treas. ALBERT J. FITZ, Supt.

SCHENECTADY LOCOMOTIVE WORKS,
Schenectady, N. Y.



LOCOMOTIVES OF STANDARD DESIGN FOR ALL CLASSES OF SERVICE
Or from Designs Furnished by Railroad Companies.
ANNUAL CAPACITY, 400.

HENDRICKS BROS.,

BELLEVILLE COPPER ROLLING MILLS,
40 CLIFF STREET, NEW YORK

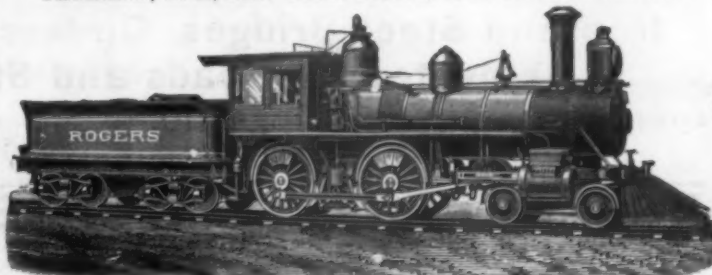
MANUFACTURERS OF

BRAZERS, COPPER LOCOMO-
BOLT, TIVE
SHEATHING. COPPER FURNACE.
COPPER WIRE AND RIVETS.

IMPORTERS AND DEALERS IN
INGOT COPPER, BLOCK TIN, SPELTER, LEAD
ANTIMONY, BABBITT METAL, SOLDER, ETC.

COPPER

ROGERS LOCOMOTIVE & MACHINE WORKS
PATERSON, N. J.; NEW YORK OFFICE, 44 EXCHANGE PLACE.



MANUFACTURERS OF

Locomotive Engines and Tenders and other Railroad Machinery
J. S. ROGERS, President. { PATERSON, N. J. H. S. HUGHES, Treas.
JOHN HAVRON, Secretary. { 44 Exchange Place, New York
REUBEN WELLS, Superintendent.

COMPOUND LOCOMOTIVES

PATENT AUTOMATIC INTERCEPTING AND STARTING VALVE.

The best results of COMPOUNDING LOCOMOTIVES have been obtained by the use of the

Worsdell, Von Borries & Lapage's System.

LICENSE to build Locomotives granted under the Patents of

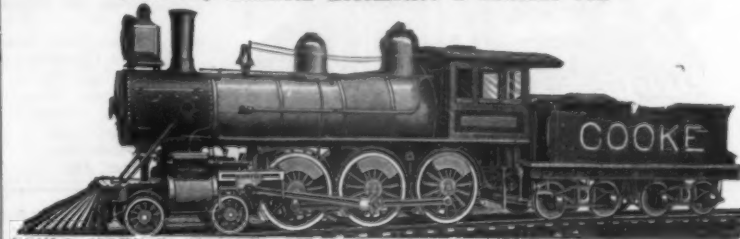
WORSDELL, VON BORRIES AND LAPAGE.

We are prepared to furnish Railroad Officers and Locomotive Builders with full particulars showing the Economy of the COMPOUND, together with working drawings, etc.

ADDRESS CORRESPONDENCE TO

G. L. FOWLER, 53 Broadway, NEW YORK.
TAITE & CARLTON, 63 Queen Victoria St., London, Eng.

COOKE LOCOMOTIVE & MACHINE CO. Paterson, N. J.
(Formerly Danforth Locomotive & Machine Co.)



JOHN S. COOKE, President & Gen. Man. } PATERSON, N. J.
FRED. W. COOKE, Vice-President.
WM. BERDAN, Sec'y & Treas.

New York Office,
45 BROADWAY.
H. A. ALLEN, Agent.

PITTSBURGH LOCOMOTIVE & CAR WORKS
PITTSBURGH, PA.



MANUFACTURERS OF

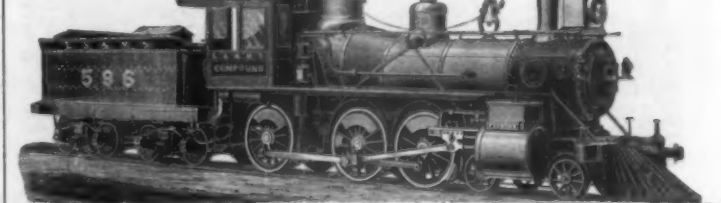
LOCOMOTIVE ENGINES FOR BROAD OR NARROW GAUGE ROADS.

From standard designs, or according to specifications, to suit purchasers.

Tanks, Locomotive or Stationary Boilers Furnished at Short Notice.

D. A. STEWART, Pres't. D. A. WIGHTMAN, Supt. WILSON MILLER, Sec. and Treas.

BROOKS LOCOMOTIVE WORKS, Dunkirk, N. Y.



Builders of Locomotive Engines for any required service from our own designs or those of purchasers. Perfect interchangeability and all work fully guaranteed.

COMPUND LOCOMOTIVES for Passenger and Freight Service.

M. L. HINMAN, Pres't and Treas. R. J. GROSS, Vice-Pres't. T. M. HEQUENBORG, Sec'y.
DAVID RUSSELL, Supt. H. TANDY, Asst. Supt.

JULL CENTRIFUGAL SNOW EXCAVATOR.

MANUFACTURED BY THE

JULL M'F'G. CO.

189 MONTAGUE ST.
BROOKLYN, N. Y.



THE KING BRIDGE COMPANY.

Iron and Steel Bridges, Girders, Turntables, Buildings, Eye Bars,
Elevated Railroads and Structural Work of all kinds.

OFFICE AND WORKS: CLEVELAND, OHIO.

CHICAGO OFFICE: 1105-1107 ROOKERY BUILDING.
NEW YORK OFFICE: WELLES BUILDING, 18 BROADWAY

CAPACITY, 20,000 TONS PER ANNUM.

BOSTON BRIDGE WORKS

D. H. ANDREWS, Proprietor.

70 KILBY ST., BOSTON, MASS.



DESIGNERS AND BUILDERS OF
Railroad Bridges and Heavy Wrought Iron Structural Work
OF EVERY DESCRIPTION.
SUPERIOR WROUGHT IRON TURNABLES A SPECIALTY.
Works on Grand Junction Railroad.

MO VALLEY BRIDGE & IRON WORKS

LEAVENWORTH, KAN.

A. J. TULLOCK
Proprietor.

MANUFACTURERS AND BUILDERS OF

Wrought Iron, Steel, Howe
Truss and Combination
Bridges, Turn Tables,
Draw Spans, Roof
Trusses, Piers
Substructures
Foundations,
Etc., Etc.



CHAS. M. JARVIS, Pres. & Chf. Engr.
FRANK L. WILCOX, Treas.

BURR K. FIELD, Vice-Prest.
GEO. H. SAGE, Secy.

THE BERLIN IRON BRIDGE CO., EAST BERLIN, CONN.



The above illustration is taken direct from a photograph of a Plate Girder Trestle
Bridge designed and built by us for the M., W. & C. R. R. R.,
at Waterbury, Conn.

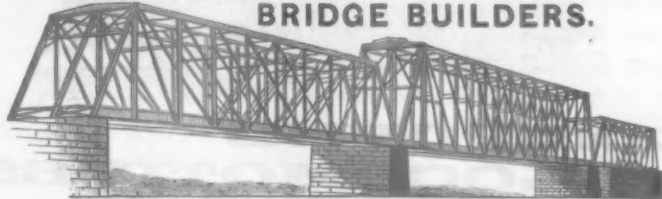
SEND FOR ILLUSTRATED CATALOGUE.

OFFICE AND WORKS:

No. 1 RAILROAD AVE., EAST BERLIN, CONN.

WORKS AT PATTERSON, N. J. Passaic Rolling Mill Co. NEW YORK OFFICE: Aldrich Court, 45 Broadway

BRIDGE BUILDERS.



N. Y., Lake & Western Ry.—Erie Crossing at Buffalo.
Wrought Iron Railroad & Highway Bridges, Turn Tables & Roofs.
All made from the best material of our own manufacture. Manufacturers of all kinds of Iron
and Iron Work for Bridges and Buildings. Plans and Estimates furnished.
WATTS COOKE, Pres. W. O. FAYERWEATHER, Treas. G. H. BLAKELEY, Chf. Engr

CHAR. KELLOGG,
Pres.

ROBT. GRIMES,
Vice-Prest.

WALTER HAWKINS,
Treas.

W. S. McCORD
Secy.

ELMIRA BRIDGE COMPANY,

(LIMITED)

ENGINEERS AND MANUFACTURERS.

Steel & Iron Bridges, Roofs & Turntables

ELMIRA, N. Y.

OFFICE AND WORKS:

Elmira, N. Y.

NEW YORK OFFICE:

18 Broadway.

S. W. FRESCOLN,

ENGINEER AND CONTRACTOR,
WORLD BUILDING, NEW YORK CITY,
—DESIGNS AND BUILDS—

Bridges, Viaducts, Iron and Steel Structures, Rail-
roads, Pneumatic Foundations, Harbor Works.

NEW JERSEY STEEL & IRON CO

TRENTON, N. J.

BUILDERS OF

BRIDGES, ROOFS, Etc.

COOPER, HEWITT & CO.,

17 Burling Slip, New York.

Plans and Estimates Furnished for Draws, Fixed Spans, Etc.

ROCHESTER BRIDGE & IRON WORKS,

J. F. ALDEN,

Successors to Alden & Laseig and Leighton Bridge & Iron Works,
ROCHESTER, N. Y.



—DESIGNERS AND BUILDERS—

WROUGHT IRON AND STEEL WORK FOR BRIDGES AND BUILDINGS.

LOUISVILLE BRIDGE & IRON COMPANY

OFFICE AND WORKS: CORNER OLDHAM AND 11TH STS., LOUISVILLE

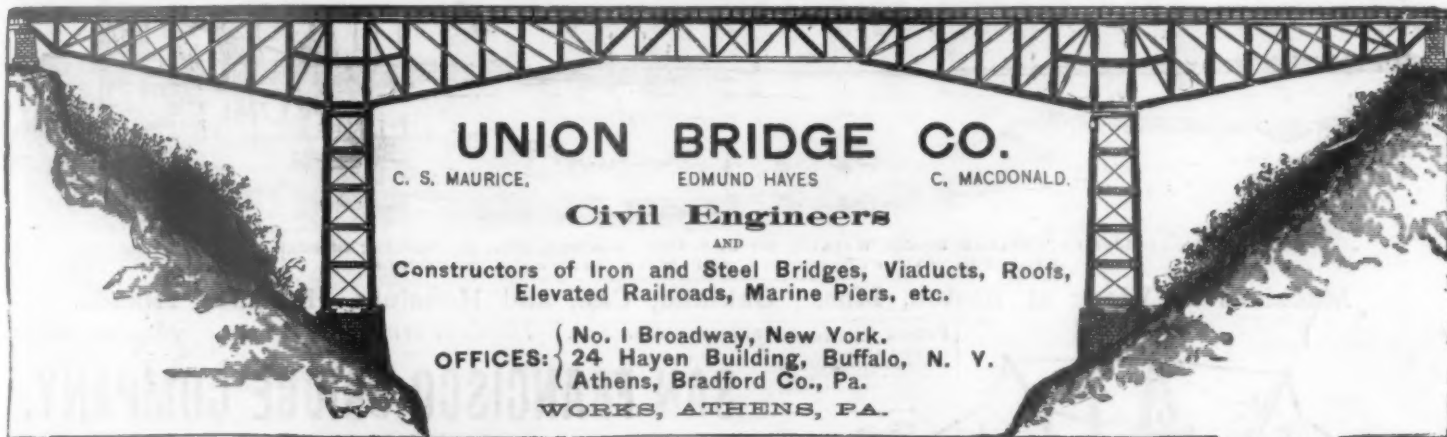


BUILDERS OF

TRIANGULAR, WHIPPLE AND FINK TRUSSES.

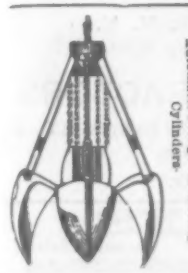
and other forms of Iron and Combination Bridges. Also Manufacturers of Iron Roofs, Turn
Tables, Frogs, Switches, etc.

J. M. JOHNSON, Pres. & Engr. E. BENJAMIN, Vice-Pres. F. H. VAUGHAN, Sec. & Treas.

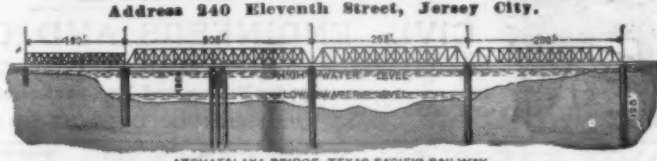


UNION BRIDGE CO.
C. S. MAURICE, EDMUND HAYES, C. MACDONALD.
Civil Engineers
AND
Constructors of Iron and Steel Bridges, Viaducts, Roofs,
Elevated Railroads, Marine Piers, etc.

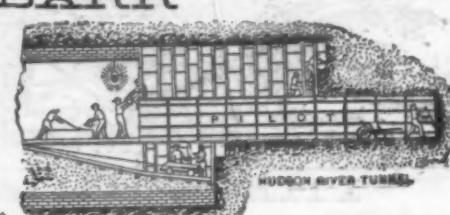
OFFICES: { No. 1 Broadway, New York.
24 Hayen Building, Buffalo, N. Y.
Athens, Bradford Co., Pa.
WORKS, ATHENS, PA.



J. F. ANDERSON, **ANDERSON & BARR** C. C. BARR
ENGINEERS AND CONTRACTORS.
Address 240 Eleventh Street, Jersey City.



ATCHAFALAYA BRIDGE, TEXAS PACIFIC RAILWAY




HUDSON RIVER TUNNEL

Pneumatic Work, Deep Foundations and Tunneling in Soft Materials Specialties
Control the Patents for the Automatic Dredge and the Anderson System of Tunneling.

THE PHOENIX BRIDGE CO. Successors to Clarke, Reeves & Co. **PHOENIXVILLE BRIDGE WORKS**
ENGINEERS AND BUILDERS OF
Bridges, Viaducts, Roofs, Turn-Tables, Etc.

SPECIALTIES:
Accurate Workmanship;
the use of Double-Refined
Iron; no welds; Phoenix
Upper-chords and Posts;
the best form of Strut
known.



CATSKILL BRIDGE.



ALL WORK DONE ON THE PREMISES - FROM ORE TO FINISHED BRIDGES.
ILLUSTRATED ALBUM
Mailed on receipt of \$3.00.

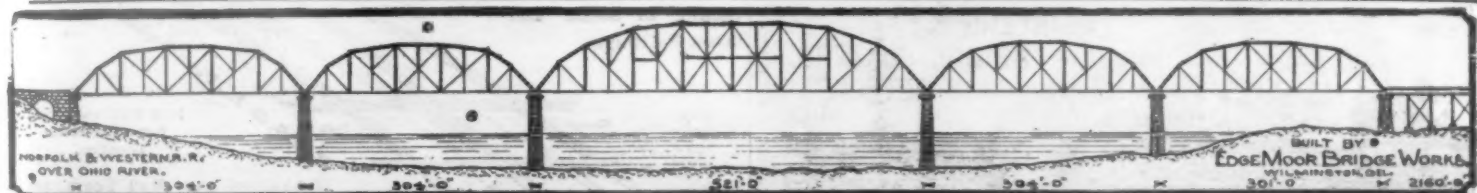
DAVID REEVES, President. ADOLPHUS BONZANO, Vice-Pres. and Chief Eng'r. WILLIAM H. REEVES, Gen. Supt. FRANK T. DAVIS, Asst. Supt.

Office: 410 Walnut St., Phila.
49 William St., New York
Phoenixville, Pa.

A. & P. ROBERTS & COMPANY.
PENCOYD IRON WORKS MANUFACTURERS OF **PENCOYD BRIDGE & CONSTRUCTION COMPANY**
Wrought Iron and Open Hearth Steel, BRIDGES, VIADUCTS, TURN TABLES, Etc.
OFFICE: 261 S. 4th Street, PHILADELPHIA, Pa. WORKS, PENCOYD, PA.

THE POTTSVILLE BRIDGE COMPANY,
DESIGNERS AND BUILDERS OF
BRIDGES, VIADUCTS, ROOFS, ETC.
Office: No. 226 South Fourth Street, Philadelphia, Pa. Works: Pottsville, Pa.
KEYSTONE BRIDGE CO.

GENERAL OFFICE AND WORKS, PITTSBURGH, PA.
WESTERN OFFICE, 205 LaSalle St., CHICAGO, ILL. EASTERN OFFICE, 46 WALL ST., NEW YORK.

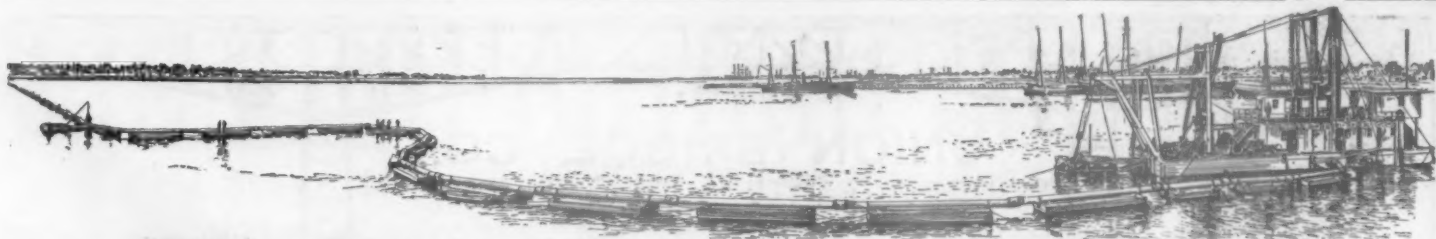


SHIFFLER BRIDGE COMPANY,
DESIGNERS AND MANUFACTURERS OF
Railway Bridges, Viaducts, Train Sheds, Girders, Roof Trusses, Iron Buildings, Etc.
Office and Works: 48th STREET and A. V. R. R., PITTSBURGH, PA.

THE PITTSBURGH BRIDGE CO.
WESTERN OFFICE: 1103 OWINGS BUILDING, CHICAGO.
W. W. CURTIS, Western Representative.

THE YOUNGSTOWN BRIDGE CO.
MANUFACTURERS OF
IRON & STEEL BRIDGES
IRON STRUCTURAL WORK, IRON ROOF AND TURN TABLES
YOUNGSTOWN, O.
James Neilson, Pres. W. L. Cowles, Ch. Eng. R. E. Carson, Vice-Pres. S. F. Boyd, Sec. Treas.

CHICAGO BRIDGE & IRON CO
443 Rookery Building, CHICAGO, ILL.
Works: 105 & 106 Sts., Rock Island & Panhandle Railroad.
Successors to Kansas City Bridge & Iron Co., Kansas City, Mo.; Horace E. Horton
Rochester, Minn.
MANUFACTURERS OF
METALS for STRUCTURES.
CONTRACTORS AND BUILDERS
Steel, Iron and Combination Bridges. Masonry and Metal Substructures.



San Francisco Bridge Co.'s Suction Dredge Working for U. S. Gov., Oakland, Cal., Discharging through 5,700 ft. Pipe.
WILL DIG AND PUT ASHORE ANY MATERIAL, ROCK EXCEPTED.

Machines at Work at Boston, Mass., Oakland, Cal., and Honolulu, Hawaiian Islands.

Patent Excavator. ESTABLISHED 1877. INCORPORATED 1883. CAPITAL (PAID UP) \$950,000.

Now (1892) successfully completing (as one operation) a Canal in Colusa County, Cal., 100 ft. wide, 20 ft. deep, and 6 miles long.

SAN FRANCISCO BRIDGE COMPANY.

J. McMULLEN, Pres.
J. M. TAYLOR, Sec. and Treas.

GEO. W. CATT, C. E., Vice-Pres.
H. S. WOODS, Engineer.

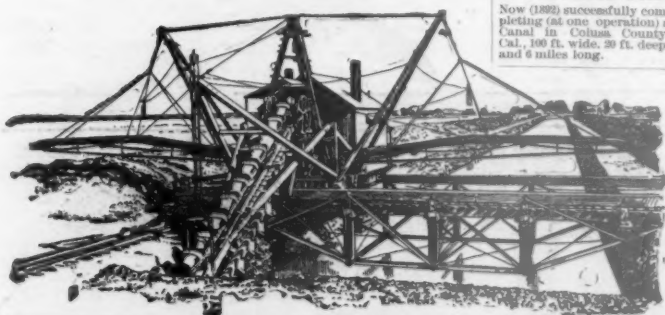
H. KRUSI, Chief Engineer.
J. B. C. LOCKWOOD, Eng'r.

OFFICES: { World Building, New York, N. Y.
San Francisco, Cal., Seattle, Wash.

CIVIL ENGINEERS AND CONTRACTORS.

SPECIALTIES: Machinery for Economical Excavation of Canals; for Suction Dredging; for Filling and Reclamation of Low Lands.

CORRESPONDENCE SOLICITED.



THE PHILADELPHIA BRIDGE WORKS.

JOS. H. COFRODE.

OHIO RIVER BRIDGE AT BEAVER, PA.—CHANNEL SPAN 446 FEET.

FRANCIS H. SAYLOR.



COFRODE & SAYLOR, Civil Engineers and Bridge Builders, design and construct Iron Wooden and Combination Bridges, Roofs Locomotive Turn-Tables etc. Office: No. 257 South Fourth Street, Philadelphia.

CREOSOTED MATERIAL.

THE CREOSOTE LUMBER & CONSTRUCTION CO.,
OF FERNANDINA, FLA.

Furnishes CREOSOTED MATERIAL of all kinds by the cargo and carload. Manufacturers of WOOD CREOSOTE OIL, the only oil used at their works in protecting timber against decay and the ravages of the sawworms. Shipping facilities unsurpassed by rail and water. Write for circular and prices. B. T. BURCHARDI, Chief Engineer and Superintendent.

SOOYSMITH & COMPANY

(INCORPORATED).

CONTRACTING ENGINEERS,

Design and build in any part of the country

BRIDGE PIERS, PNEUMATIC CAISSON FOUNDATIONS, TUNNELS.
MARINE PIERS, DOCKS, LIGHTHOUSES,

AND ALL KINDS OF ENGINEERING CONSTRUCTIONS.

THE FREEZING METHOD

Now in use by us, and for which we control the American Patent, makes the construction subaqueous tunnels, deep foundations, shafts, etc., practicable in soft or water-bearing ground and to depths hitherto unattainable.

Main Office, - - No. 2 NASSAU STREET, NEW YORK.



DETROIT BRIDGE & IRON WORKS

ENGINEERS &
BRIDGE BUILDERS
DETROIT MICH.

STEEL, IRON, AND COMBINATION
BRIDGES, ROADS, VIADUCTS, TURN TABLES

R. A. SHAILER.

C. R. SCHNIGLAU.

SHAILER & SCHNIGLAU,

Successors to W. C. COOLIDGE & CO.,

Engineers and Contractors,

DESIGNERS AND BUILDERS OF
BRIDGES, BUILDINGS AND SUBSTRUCTURES.

609 610 & 611 Phenix Building, 138 Jackson St., Chicago, Ill.

THE WALLIS IRON WORKS.

Iron Buildings, Bridges, Turntables, Roofs and Riveted Girders

SOLE MANUFACTURERS OF THE PERKINS PATENT SHUTTERS.

Main office and works: 7, 9, 11, 13, 15 Morris and 5 and 9 Essex Sts.

Telephone, 38.

JERSEY CITY, N. J.

NEW YORK OFFICE, 95 LIBERTY STREET.

ALEX. MCCLURE,

MANUFACTURER OF

LONG PINE BRIDGE TIMBER.

PITTSBURGH, PA.

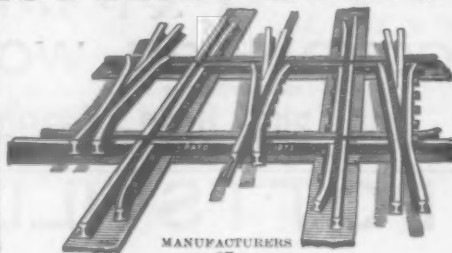
Capacity, 150,000 Feet Per Day.

Run all the Year. Can Fill Orders in Winter on Short Notice.

ELLIOT FROG & SWITCH CO.

RICID FROGS
LAP SWITCHES.

Handle of any Weight or Section
Desired Carried in Stock.



MANUFACTURERS
OF

Wrought Iron Head Chairs, Rail Braces, Bridge Rods and every description of Railroad Iron Work. Catalogue and other information furnished on application. EAST ST. LOUIS, ILL.

SPRING RAIL FROGS
SPLIT SWITCHES.
AUTOMATIC SWITCH STANDS.

SAMUEL LEES
President.

EDWARD H. JOHNSTON,
General Manager.

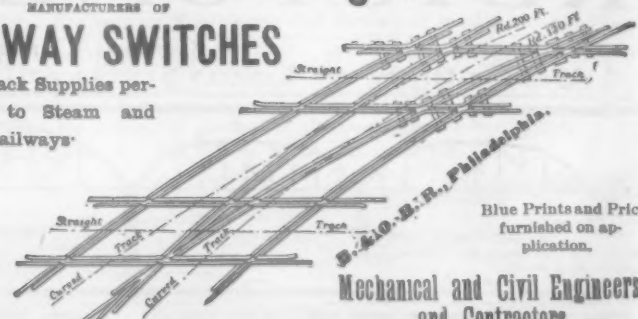
AMOR GARTSIDE,
Treasurer.

Johnston Railroad Frog & Switch Co.

MANUFACTURERS OF

RAILWAY SWITCHES

All Track Supplies pertaining to Steam and Street Railways.



Blue Prints and Price furnished on application.

Mechanical and Civil Engineers and Contractors.

OFFICE AND WORKS, CHESTER, PA.



PATENTED DEVICES.
For Tapping Stay-Bolt Holes which are behind the Drivers, Frames, etc., without the removal of any of the parts of the Engine.

RADIAL TAPS.
Especially adapted for long distances, and suitable to any required size.

Address J. T. Connelly, Milton, Pa.

;000.

neer.
Eng'r.

S.
redg-

OR.

oofs

AUTOMATIC SWITCH STANDS. O

N O.

Pric

ers

m

CS,
nd
val

ult-

Pa.

1.
2.
8.

L.

18

Ra

tend
Inter
is de
T
belon
politi

CHAPT
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
XVI
XVII

For Se

T
A di
sylvania
100 pages
The
patching
good and
mission.
telegraph
plication
the stand
track, ne
book and
ents or
departme
Publish

AUTOMATIC UNION STATE

etc

ERS

ES,
ehind
novat

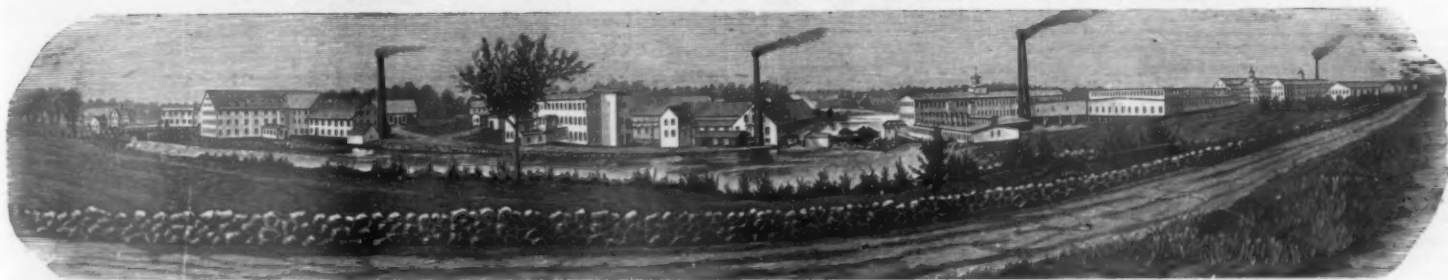
suit-

Pa.

SANFORD MILLS,

MANUFACTURERS OF

CAR PLUSHES.



WE CLAIM FOR OUR CAR PLUSHES:

1. SUPERIORITY IN QUALITY AND FINISH TO ANY FOREIGN GOODS.
2. MORE DURABILITY IN COLORS THAN FOREIGN, AS DEMONSTRATED BY ACTUAL TESTS.
3. THAT THE ABOVE ARE FACTS IS PROVED BY THE CONTINUED SUPPORT OF THE BEST CAR-BUILDERS IN THE COUNTRY.

WE CAN FURNISH ANY COLOR OR SHADE DESIRED.

L. C. CHASE & CO., Selling Agents, 129 Washington St., Boston, Mass.
338 BROADWAY, NEW YORK. 260 FIFTH AVENUE, CHICAGO.

1892. JUST PUBLISHED. 1892.

Railway Rates and Government Control.

By MARSHALL M. KIRKMAN. Price \$2.50.

An exhaustive study of the bases of railway rates and of the influences which tend to determine them; of Pools, Special Rates and Discriminations; of State and Interstate Traffic. A Determination of the conditions when Government interference is desirable and not desirable.

This book is the first to classify and assign the traffic of railroads where it belongs, viz., among the competitive interests of the world. It is a question of political economy, and the author has studied it exhaustively from this point of view.

CONTENTS:

- CHAPTER I. The Ethics of Trade, including that of Carriers.
- II. Railway rates; their bases and the influences affecting them.
- III. Railway rates; their bases and the influences affecting them.
- IV. Railway rates; their bases and the influences affecting them.
- V. Railway rates; discrimination; pools.
- VI. Special rates and their relation to commerce.
- VII. Necessity and value of Traffic agreements.
- VIII. Railway rates and Government control. Rates may be too low, they cannot be too high. Railway enterprise. Proper scope of governmental supervision.
- IX. Railway rates and government control. Railway growth in the United States. Present status. Methods of railroads. The limits within which legislative interference is valuable.
- X. Value of private ownership and interest. Government control; its inadequacy.
- XI. Government supervision and control; its limitations. The value of private ownership. Further reference to rates; principles underlying them.
- XII. Government control versus private control. When government control is desirable; when undesirable; its tendencies.
- XIII. The tenure of railways under the law. The interstate commerce law of the United States. The requirements of the English law.
- XIV. Mutualities of interest in the prosperity of railroads.
- XV. Cost of railroads not fully capitalized; the reasons why; effect on rates.
- XVI. Local and through traffic; State versus interstate traffic; impossibility of distinguishing one from the other; effect on legislative action.
- XVII. Moderation exercised by wise governments in meddling with the rates of railways and in exercising their police powers; the reasons therefor. The status of railroads in England, Canada, Australia, Germany, France, Austria-Hungary, Belgium, Spain and Portugal, Italy, Russia and Japan.

For Sale by THE RAILROAD GAZETTE, 73 Broadway, NEW YORK.

NEW REVISED, ENLARGED EDITION OF THE TRAIN WIRE

A discussion of the science of train dispatching. By J. A. ANDERSON, of the Pennsylvania Railroad, with an introduction by B. B. ADAMS, Jr., of the Railroad Gazette.

The first eight chapters are discussions of the general principles, and treat of: Train Dispatching, the Dispatcher, the Operator, the Order (with photographic illustrations of very good and very bad manuscripts), the Manifest, the Record, the Train-Order Signal, the Transmission. Chapter Nine contains the standard code of rules for the movement of trains by telegraphic orders, with comments on each rule, giving valuable practical advice as to its application in special cases, and making its purpose and necessity clear. Chapter Ten contains the standard forms of train orders, and the remaining chapters treat of rules as to rights of track, numbering switches, etc. The book is complete and exhaustive as a practical handbook and course of instruction for an inexperienced operator, and there are few superintendents or dispatchers who may not learn much from Mr. Anderson's long experience in this department. He is probably the best authority in the world on train dispatching.

Published and for Sale by THE RAILROAD GAZETTE, 73 Broadway, New York.

AMERICAN PRACTICE

—IN—

BLOCK SIGNALING,

With Descriptions and Drawings of the Different Systems in Use on Railroads in the United States.

This is a handsomely printed, elegantly bound volume, 7 1/4 in. x 9 in. It describes clearly the Simple Block System, Single Track Blocking Sykes' System, Automatic Clockwork Track Circuit Signals and the Electro-Pneumatic Track-Circuit System. It contains elaborately illustrated descriptions of the systems in use on the Pennsylvania, Boston & Albany, Pittsburgh and New York Central roads, and correct engravings and descriptions of the Westinghouse Pneumatic, the Hall Automatic and Black's Automatic Systems; and also of the Illuminated Semaphore, Koyl's Parabolic Semaphore and the Stewart Hall Train Order Signal.

The book is designed to make the methods of block signaling clearly understood and to show the present development of the art on American railroads.

PRICE, \$2.00.

PUBLISHED AND FOR SALE BY

THE RAILROAD GAZETTE, 73 Broadway, New York.

"Hand Book of Freight Accounts."

A Treatise on the Conduct of Freight Accounts at Stations, and the legal requirements that must be observed at such places in handling freight. A manual.

By MARSHALL M. KIRKMAN.

PRICE \$2.00.

For Sale by THE RAILROAD GAZETTE, 73 BROADWAY, NEW YORK.

The Economic Theory of the Location of Railways

An analysis of the conditions controlling the laying out of railways to effect the most judicious expenditure of capital.

By A. M. WELLINGTON.

Railroad officers desiring to determine what can be done in the way of improving the operated lines under their charge, or desiring to have at their immediate command statistical facts as to almost any detail of operation, as well as Railroad Engineers and Engineering Students, will find this AN INDISPENSABLE WORK, as being not only the best but the only treatise in the language of an at all analogous nature.

PRICE, post-paid..... \$5.00 per copy.
Five or more copies to one address, express charges paid by purchaser... \$4.00 per copy.

THE RAILROAD GAZETTE, 73 BROADWAY, N.Y.

1892



250,000.

Y.

Engineer.
O, Eng'r.

RS.

n Dredg-

BAYLOR.



, Roofs

CO

FOR HING HALL T HOOD
SPLIT SWITCHES.
AUTOMATIC SWITCH STANDS.

ARTSIDE,
racer.

h·Co.



rints and Pric
shed on ap-
lication.

Engineers

OPS.

PA.

Just



VICES,
hich are behind
ut the removal

PS,

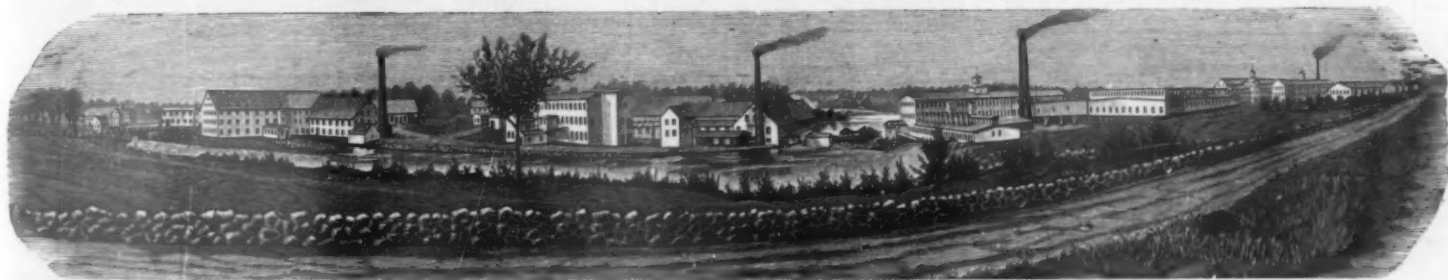
ances, and suit-

Milton, Pa.

SANFORD MILLS,

MANUFACTURERS OF

CAR PLUSHES.



WE CLAIM FOR OUR CAR PLUSHES:

1. SUPERIORITY IN QUALITY AND FINISH TO ANY FOREIGN GOODS.
2. MORE DURABILITY IN COLORS THAN FOREIGN, AS DEMONSTRATED BY ACTUAL TESTS.
3. THAT THE ABOVE ARE FACTS IS PROVED BY THE CONTINUED SUPPORT OF THE BEST CAR-BUILDERS IN THE COUNTRY.

WE CAN FURNISH ANY COLOR OR SHADE DESIRED.

L. C. CHASE & CO., Selling Agents, 129 Washington St., Boston, Mass.
338 BROADWAY, NEW YORK. 260 FIFTH AVENUE, CHICAGO.

1892. JUST PUBLISHED. 1892.

Railway Rates and Government Control.

By MARSHALL M. KIRKMAN. Price \$2.50.

An exhaustive study of the bases of railway rates and of the influences which tend to determine them; of Pools, Special Rates and Discriminations; of State and Interstate Traffic. A Determination of the conditions when Government interference is desirable and not desirable.

This book is the first to classify and assign the traffic of railroads where it belongs, viz., among the competitive interests of the world. It is a question of political economy, and the author has studied it exhaustively from this point of view.

CONTENTS:

- CHAPTER
- I. The Ethics of Trade, including that of Carriers.
 - II. Railway rates; their bases and the influences affecting them.
 - III. Railway rates; their bases and the influences affecting them.
 - IV. Railway rates; their bases and the influences affecting them.
 - V. Railway rates; discrimination; pools.
 - VI. Special rates and their relation to commerce.
 - VII. Necessity and value of Traffic agreements.
 - VIII. Railway rates and Government control. Rates may be too low, they cannot be too high. Railway enterprise. Proper scope of governmental supervision.
 - IX. Railway rates and government control. Railway growth in the United States. Present status. Methods of railroads. The limits within which legislative interference is valuable.
 - X. Value of private ownership and interest. Government control; its inadequacy.
 - XI. Government supervision and control; its limitations. The value of private ownership. Further reference to rates; principles underlying them.
 - XII. Government control versus private control. When government control is desirable; when undesirable; its tendencies.
 - XIII. The tenure of railways under the law. The interstate commerce law of the United States. The requirements of the English law.
 - XIV. Mutuality of interest in the prosperity of railroads.
 - XV. Cost of railroads not fully capitalized; the reasons why; effect on rates.
 - XVI. Local and through traffic; State versus interstate traffic; impossibility of distinguishing one from the other; effect on legislative action.
 - XVII. Moderation exercised by wise governments in meddling with the rates of railways and in exercising their police powers; the reasons therefor. The status of railroads in England, Canada, Austria, Germany, France, Austria-Hungary, Belgium, Spain and Portugal, Italy, Russia and Japan.

For Sale by THE RAILROAD GAZETTE, 73 Broadway, NEW YORK.

NEW REVISED, ENLARGED EDITION OF THE TRAIN WIRE

A discussion of the science of train dispatching. By J. A. ANDERSON, of the Pennsylvania Railroad, with an introduction by B. B. ADAMS, Jr., of the Railroad Gazette.

The first eight chapters are discussions of the general principles, and treat of: Train Dispatching, the Dispatcher, the Operator, the Order (with photographic illustrations of very good and very bad manuscripts), the Manifest, the Record, the Train-Order Signal, the Transmission. Chapter Nine contains the standard code of rules for the movement of trains by telegraphic orders, with comments on each rule, giving valuable practical advice as to its application in special cases, and making its purpose and necessity clear. Chapter Ten contains the standard forms of train orders, and the remaining chapters treat of rules as to rights of track, numbering switches, etc. The book is complete and exhaustive as a practical handbook and course of instruction for an inexperienced operator, and there are few superintendents or dispatchers who may not learn much from Mr. Anderson's long experience in this department. He is probably the best authority in the world on train dispatching.

Published and for Sale by THE RAILROAD GAZETTE, 73 Broadway, New York.

AMERICAN PRACTICE

—IN—

BLOCK SIGNALING,

With Descriptions and Drawings of the Different Systems in Use on Railroads in the United States.

This is a handsomely printed, elegantly bound volume, 7 1/4 in. x 9 in. It describes clearly the Simple Block System, Single Track Blocking System, Automatic Clockwork Track Circuit Signals and the Electro-Pneumatic Track-Circuit System.

It contains elaborately illustrated descriptions of the systems in use on the Pennsylvania, Boston & Albany, Fitchburg and New York Central roads, and correct engravings and descriptions of the Westinghouse Pneumatic, the Hall Automatic and Black's Automatic Systems; and also of the Illuminated Semaphore, Koyl's Parabolic Semaphore and the Stewart Hall Train Order Signal.

The book is designed to make the methods of block signaling clearly understood and to show the present development of the art on American railroads.

PRICE, \$2.00.

PUBLISHED AND FOR SALE BY

THE RAILROAD GAZETTE, 73 Broadway, New York.

"Hand Book of Freight Accounts."

A Treatise on the Conduct of Freight Accounts at Stations, and the legal requirements that must be observed at such places in handling freight. A manual.

By MARSHALL M. KIRKMAN.

PRICE \$2.00.

For Sale by THE RAILROAD GAZETTE, 73 BROADWAY, NEW YORK.

The Economic Theory of the Location of Railways

An analysis of the conditions controlling the laying out of railways to effect the most judicious expenditure of capital.

By A. M. WELLINGTON.

Railroad officers desiring to determine what can be done in the way of improving the operation of their lines, or desiring to have at their immediate command statistical facts as to almost any detail of operation, as well as Railroad Engineers and Engineering Students, will find this AN INDISPENSABLE WORK, as being not only the best but the only treatise in the language of an at all analogous nature.

PRICE, post-paid, \$5.00 per copy. Five or more copies to one address, express charges paid by purchaser... \$4.00 per copy.

THE RAILROAD GAZETTE, 73 BROADWAY, N.Y.

HENRY D. LAUGHLIN, Prest.
E. B. LEIGH, V. P. and Gen'l Mgr.
A. J. FARLEY, Secy.
L. C. BURGESS, Supt.
GENERAL OFFICE AND WORKS:
40th and Hopkins St. Chicago.
CITY OFFICE:
614 Phenix Building, Chicago.
NEW YORK OFFICE:
Room 118, 29 Broadway.
FRED'K G. ELY, Eastern Agent.



A Perfectly Constructed Metal Brake Beam
The Cheapest, Lightest and most Durable.
Now Standard on a large number of roads throughout the country.
Correspondence Solicited.

The Best Rail Fastening in the World for the Money!
THE GOLDIE PERFECT RAILROAD SPIKE IN SOFT STEEL
DILWORTH, PORTER & CO., Ltd., Pittsburgh, Pa.

OR { C. H. MEYUM, 213 Phenix Bldg., Chicago. } AGENTS { H. C. McNAIR, St. Paul.
M. M. BUCK & CO., St. Louis. } { C. M. NOYES, Milwaukee }

THE MOST DESIRABLE



Manufactured in Four Different Patterns.
CORRESPONDENCE SOLICITED.

SHEFFIELD VELOCIPEDE CAR COMPANY. Three Rivers, Mich.

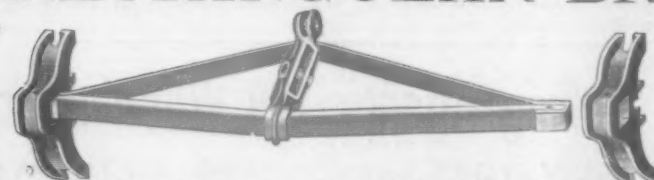
"Machined" Car Wheels.

600,000 Made under our
SYSTEM OF COMPARATIVE TESTS
Without one case of breakage in service.
We contract to regrind our wheels at points of removal, saving freight and increasing total life of wheels from 100 to 300 per cent.

NEW YORK CAR WHEEL WORKS, BUFFALO, N. Y.
NEW YORK OFFICE: COR. BANK AND WEST STS.

KEWANEE RECTANGULAR BRAKE BEAM.

WEIGHT OF PASSENGER BEAM,
75 LBS.
WEIGHT OF FREIGHT BEAM,
60 LBS.



Heads Well Fitted On, Riveted, and Cannot Work Loose or Get Out of Alignment.

MAXIMUM VERTICAL STIFFNESS.
MINIMUM COST OF MAINTENANCE

ANY STYLE OF HEADS FURNISHED
NO NUTS OR BOLTS.

Meets All M. C. B. Requirements.

EDWARD I. FROST, Vice-Prest.
CHARLES L. SULLIVAN, Gen. Supt. **NORTHWESTERN EQUIPMENT CO.,** Monadnock Building, CHICAGO, ILL.

SHARON STEEL CASTING CO.,
SHARON, PA.

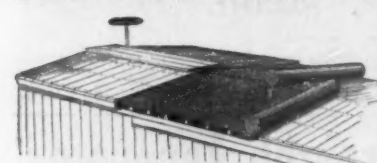
OPEN HEARTH STEEL CASTINGS.
Equal to Forgings.

RAILROAD WORK A SPECIALTY. SEND FOR PRICES.

STEEL CASTINGS

True to Pattern, sound, solid, free from blow-holes, and of great strength. Stronger and more reliable than iron forgings in any position. 20,000 Knuckles, 60,000 CRANK SHAFTS, 100,000 WHEELS of this steel now running on the roads. Cross Heads, Rockers, Piston Rods, and Locomotive STEEL CASTINGS. Send for Circulars and Prices to **CHESTER STEEL CASTINGS CO.** Works, Chester, Pa. Office, 407 Library St., Philadelphia, Pa.

THE HUTCHINS FREIGHT CAR ROOF.

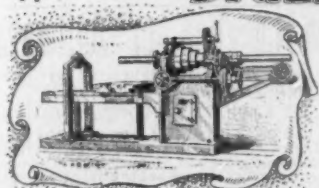


This roof has been in extensive use for over twelve years. It is strong, durable and attractive in appearance and costs less than a grooved board roof. In repairing old cars, the under course of boards can always be utilized—a great saving—making it the cheapest and best roof for repair work in the market. This roof is standard on a large number of leading railroads in the country. Send for Pamphlet and Blue Print.

C. B. HUTCHINS & SONS, DETROIT, MICH.
Chicago Office: 904 "The Rookery."

THE MT. VERNON BRIDGE CO., MT. VERNON, O.
IRON and STEEL BRIDGES, BUILDINGS, Etc.

Horizontal **DRILLING AND BORING MACHINE**



We build all sizes of these machines, and can DELIVER PROMPTLY.

SEND FOR PRICES & CIRCULARS TO THE NEWARK MACHINE TOOL WORKS, Newark, N.J.

MAGNETO ALARM SIGNAL, FOR HIGHWAY CROSSINGS

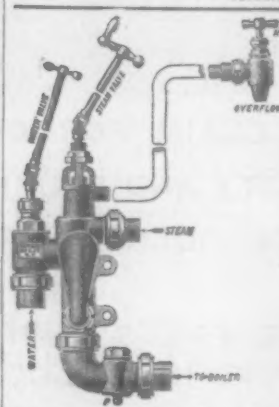
EFFICIENTLY AND ACCEPTABLY PROTECTS THE PUBLIC FROM ACCIDENT By an unmistakable warning of the approach of every train, of such vigor and emphasis as to arouse the attention of the most unwary. Gives no false alarms. Obviates employment of watchmen at the majority of crossings, at a great saving in expenditure.

MAKES ITS OWN ELECTRICITY Only as required, by passage of train over track levers of substantial Magneto Generators in strong iron cases alongside the tracks at required distance from crossing. No cup batteries are used. No freezing in winter. No failure of power. Requires only lubrication, and a little attention to working parts, at intervals.



READY AT ALL HOURS. Action incomparably better, quicker and louder than any other electric signal. No other signal has the advantage of Magneto Generators with only alternate currents, having no commutators, and constantly in circuit, with no springs or weights in striking apparatus. Furnished on approval to roads wanting to test.

Manufactured by **PENNSYLVANIA STEEL CO.,** Steelton, Pa.
STEEL RAILS of all patterns, Steel Forgings, Billets and Bars, Steel Rail FROGS, Crossings, Split Switches, Safety Switches, Switch Stands, Switch Fixtures, Etc.



THE NEW "NATHAN"
(See Illustration).

MONITOR INJECTORS
FOR LOCOMOTIVES.

"Nathan" Sight-Feed Lubricators
For Locomotive Cylinders and Air Brakes.

STEAM FIRE EXTINGUISHERS
For Switching and Yard Engines.

Boiler Washers, Rod and Guide Oil Caps, Etc.

NATHAN MFG. CO.,
92 & 94 LIBERTY STREET, NEW YORK.
SEND FOR DESCRIPTIVE CATALOGUE.

LOUISVILLE STEAM FORCE CO



CAR AND LOCOMOTIVE AXLES.

MERCHANT BAR AND FORGED IRON.
Draw-bars, Link and Pins, Follower Plates, RAILROAD FORGINGS Arch Bars, Splice Bars, Track Bolts, Bridge Rods with Plain or Upset Ends, All Sizes.

OFFICE AND WORKS: SHIPP AVENUE, COR. SIXTH. LOUISVILLE, KY.

DELAWARE, LACKAWANNA & WESTERN R. R. CO.,
MORRIS & ESSEX SHOPS,
DOVER, N. J., Dec. 28, 1891.

KNITTED MATTRESS CO., Canton Junction, Mass.

Sirs: We have been using your padding for coach seats and backs during the past five years. Have it now in about 45 to 50 coaches.

Consider it equally as good, and in some respects better than curled hair, just as durable, gives us a better shape and a more comfortable seat than curled hair, with a saving of about \$30 to each car.

Yours, etc.
(Signed) J. W. BAKER, M. C. B.

STEEL CASTINGS. **PRATT & LETCHWORTH**
PROPRIETORS,
BUFFALO STEEL FOUNDRY
Buffalo, N. Y.

Wilson's Rolling Steel Shutters

FOR FREIGHT SHEDS AND ENGINE HOUSES.



74 West 23d St., - - NEW YORK.